S M A L L P O X

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S M A L L P O X.

S Y N O N Y M S.

Variola - from Latin; varus, a blotch, a pimple;
French - La petite verole, picote, variole;
German - Blattern, Menschenpocken;
Italian - Vainlo;
Spanish - Viruelas;
Danish and Norwegèan - Kopper;
Swedish - Smittkoppor;
Arabic - (Rhazes) Jadari;
Modern Greek - tulogia;
Irish - Bolgach (puatules or blisters), galarbreac (the speckled disease);
Scotch - "the pocks"

D E F I N I T I O N.

Smallpox is an acute, specific, febrile, contagious disease preceded by an incubative period, setting in suddenly with chills, headache, backache, sweating, vomiting, and epigastric tenderness, and characterised by the evolution of symptoms in a relatively determinate order, with a cutaneous efflorescence successively papular, vesicular, and pustular in type, followed by cresting, and terminating either fatally or by complete convalescence, with or without sequelae in the form of multiple, circumscribed, and superficial cicatrices; one attack, as a rule, exhausts or destroys the susceptibility to the disease, in the same person for the remainder of life.

H I S T O R Y

The origin of smallpox is involved in much obscurity. It appears certain that the disease is not indiginous in Europe. It reached us at rather a relatively late period from other lands, no one of which, however, can with certainty be alleged to have given being to its cradle. The attempts which have been made to show that Hippocrates, Celsus, and others were acquainted with this disease may be considered as unsuccessful, and even the assumption that Europe harboured the malady at the time of Galen appears untenable.

On the other hand, from remote antiquity, tolerably unabiguous accounts of smallpox have proceeded from China and Hindostan; and indeed, according to Moore, its outbreak in these countries can be authenticated as far back as the year 1120. This statement is founded upon a work in China at that time (Teontahinfa; Treatise on Smallpox), which contains a collection of the oldest medical knowledge of the Chinese concerning this disease. It is also reported from India that long before the birth of Christ a particular goddess had been worshipped as protectress against the disease, and also, that from a remote period her priests had practised the inoculation of smallpox for protection against this evil guest. Although as Gregory, Friend, and Mead have shown, Moores dates cannot be maintained with such precision, still, on the whole, his opinion as to the great antiquity of the disease in those countries is generally accepted.

Gregory, and others, are inclined to regard as the first historically authenticated account of smallpox the celebrated description of Procopius (De Bilo Persico, lib. 11, cap. 22)) of a cource which broke out at Pelusium about the year A.D. 544, and thence spread over Egypt, Syria, and the rest of Asia Minor. They based their opinion upon certain symptoms mentioned by that author, which are undoubtedly very well referable to variola. Others have considered the epidemic of Procopius as a mixed of transition form of the buconic plague and smallpox, and believed themselves able to discover in its history grounds for this representation. Both views are now entirely abandoned, and the epidemic is universally regarded as having been that of the p lague.

Soon after, however, in the year 581, we have a account by Gregory of Tours, of an epidemic which, from the description of its historian, we must certainly recognize as variola. It raged in almost the whole of Southern Europe, as was spoken of as "Lues cum vesicis, Pustala, Pustalae, or Morbus dysentericus cum pustulis" (Hecker; Volkskrankheiten des Mittelalters); and Gregory distinctly separates it from the "Morbus inguinarius", the real buconic plague, which broke out at Narbonne in the year 582. It may appear strange that none of the physicians of that time even mention this long and destructive plague; but when it is considered how deeply the medicine of that time was sunk in mystery and superstitition, and how entirely wanting was the desire for objective investigation, we shall wonder far thereat.

Rhazes, an Arabian physician, who flourished about 910, is generally referred to as one of the earliest and best writers on smallpox. No doub t the

disease had existed for some time before he undertook to describe it; indeed, there is evidence in his work that it had, and he alludes to others who had written about it, especially to Ahron of Alexandria (sixth century) and Messue of Bagdad. The descriptions of Rhazes are comparatively clear and perspicuous, and many of his therapentic suggestions are highly judicious Thus he ordered his patients to drink cold water, combated the abuse of purgatives, and, as a rule, treated light cases expectantly by a suitable diet; he prescribed too, steam baths at the outset, and later, the inunction of oil and salt. His theory of the disease , according to which smallpox is the expression of a ferment essential to all men, a boiling up of fluids impregnated with the smallpox v irus from embryonic life, appears to us nowadays paradoxical in its details. The theory, moreover, is not peculiar to Rhazes, but it given in its principles, by Ahron and Messue. Even during the epidemic described by Gregory of Tours similar views prevailed among the people, when the term "corales" then in view for the dreaded plague, which is said to be derived from the old German "koren","kören", or"küren, i.e., "to choose", "to separate", "to purify"; therefore, indicating a sort of process of bodily purification from certain corrupt fluids. Felix, Bishop of Nantes, was, as Gresgory relates, a victim of this theory, inasmuch as, being attacked by the fever, he applied a cantharides poultice to his thigh in order to hasten this excretion, and died of gengrene in consequence.

Of Latin Writers, Salernian, and Constantius Africanus appear to have been the first to have given a scientific description of smallpox - in closest resemblance, it is true, to the descriptions of the Arabian physicians. Before Constantine little is known to us concerning the appearance of variola in Europe, except the aforementioned records of Gregory. That the disease occurred is beyond a doubt; but the limited means of communication at that time evidently prevented extensive spreading. At the time of the crusades we first see the scourge again assume terrible dimensions; just as epidemics in general cling to the heels of war and great popular tumults. At the time of the crusades too, probably, Europe first saw the erection of smallpox houses.

By importation,probably from the Netherlands, in 1493, the disease effected an entrance into Germany towards the end of the fifteenth century; while in England it had already been introduced in 1241 -- 42. Sweden was visited by the scourge at a comparatively late date in the fifteenth century. Smallpox was conveyed from Europe to the American continent soon after the discovery of America. It first raged in Mexico, in the year 1527, and to a fearful extent, sacrificing its victims in millions; thence it gradually overran. the whole of America. Later epidemics appear to have been repeatedly occasioned by the importation of negroes from Africa, the coloured races in general

being decidedly more liable to this disease than the white.

The writer has endeavoured to give above a few of the most reliable data in the defective history of smallpox, to the imcompleteness of which numerous circumstances contirbute. Not the least important of these is the fact that for a long time we did not know how to distinguish variola from other diseases. It was principally confounded with the plague, with other papulous and pustular cutanerus eruptions, and until modern times was invariably classed with measles, Sydenham first definitely drawing a sharp line between the two affections. Syphilis, also, to which the name "large-pox" had been assigned, was confounded with variola with special frequence; so that the latter was at an early date distinguished from the former as "smallpox" and "petite verole" in England and France respectively.

In most countries, as well as Europe, smallpox, long constituted one of the greatest scourges of mankind. Not a decade passed in the disease did not deciminate the inhabitants in one country or another, or over great tracts of country; so that it came to be more dreaded than the plague. Thus, in England, in the seventeenth and eighteenth centuries, 7 to 9 per cent. of all deaths were attributable to smallpox; in Berlin, from 1783 to 1797, one-twelfth of the total mortality, according to Casper, was due to the same . Junker (Arch. der Aerzte und Seelsorger wider die Pockennoth, 1798, No. 4) computed the deaths occurring from smallpox in the year 1796 among the 7.000.000 inhabitants of Prussia at 26.646. In the eighteenth century 30.000 died annually of smallpox in France. The Ancient proverb "From smallpox and love few remain free" gives the best proof of the pandemic character of the disease in the middle ages.

No matter how assiduously physicians laboured to discover a new method of treatment, none of them accomplished a result worthy of mention. The Arabian theories of the disease, requiring sweating and other remedies to "drive out the poison" were the order of the day until the first half of the seventeenth century. These notions were first overthrown by the talented Sydenham, who replaced them by the cooling antiphogistic method of treatment which we still consider rational in its fundamental principles. Yet, as may be imagined, even this treatment was but a feeble weapon against the terrible enemy.

With the introduction of the inoculation of Smallpox the great change first began in the history of variola. This was completed at a later date by Jenner's discovery of vaccination, and to-day the occurrence, intensity, and spread of the disease depend upon the manner in which this eminently protective

remedy is employed. Starting from the knowledge that Smallpox usually occurs but once in the same individual, the attempt had been made early, now and then, in Europe, to bring children intentionally into the vicinity of smallpox patients, in order that they might be protected for the remainder of their lives by means of a possibly milder form of the disease acquired in this manner. Actual inoculation of smallpox poison, however, was first practised in China and India, and even at a very remote period. It thence gradually extended through western Asia to Constantinople, where Lady Wortley Montague learned the process, and promptly subjected her son to it (1717) with a satisfactory result. She carried the method to England, where she and her daughter (1721) likewise inoculated; and she was soon enabled to bring the new process into wide esteem, despite the violent oppositions of physicians at the outset, and the silliest objections of the clergy. From England inoculation travelled rapidly to France, Germany and other European countries; and the expectation to which it gave rise were actually realised in so far that the inoculated smallpox ran a decidedly milder course than the natural disease, and also afforded the same protection as the latter against new infection. The unfortunate feature of the method, and that which eventually condemned it, was that individuals inoculated with smallpox were so likely to infect others as if they had contracted the disease naturally, so that provision was thus again made to propagate the disease.

Inoculation was entirely put an end to by the introduction of vaccination, the merits of which it possessed in a high degree, without partaking of its disadvantages. In the face of all cavil and sophistry, medical science will always count among its greates t triumphs the modifications which smallpox have undergone since its preventitive treatment was established upon a satisfactory basis by the discovery of the immortal Sir William Jenner.

E T I O L O G Y.

B a c t e r i o l o g y.

The knowledge of the bacteriology of smallpox is by no means complete. The disease is believed to be in consequence of the introduction into the system, by inoculation, i nhalation, or possibly swallowing, of the specific virus or contagium of the disease. This we are led by analogy to regard as microfic in its nature. According to Crookshank, cocci ◦5 min. in diameter, singly, in pairs, and in long or short chains and colonies, have been found by Cokn to be fresh lymph of human vaccinia and cowpox, and in the pustules of variola. Burdon Sanderson and Chanvean regard them as the active principle of vaccine lymph, since filtration deprives this of its infectious element. Weigert and Klein found the lymphatics of the skin in the region of the pustule of both human smallpox and sheep-pox filled with cocci. Successful vaccination has been stated by Quist to result from artificial cultivations. These cocci have been called "Strettococcus variolae et vacciniae". Van de Loeff and Guaernieri (Cantralbl. f. Bakt., xvi, 299) found appearances which they took to be protozoa, their results being afterwards confirmed by Pfeiffer (Monat. f. prakt. Derm., iv, 435). Mio organism was termed by them "Cytoryctes variolae", and is said to be found in the blood of vaccinated children and smallpox patients. It is described as being one-quarter the size of a blood-corposcle, and exhibits active movements, throwing out pseudopodia or flagella. It does not penetrate the blood corposcle as does the malarial parasite, but attaches itself to the side of the former. The parasite is deposited in the skin by a kind of embolic action, and thus causes the rash; in the epidermis it penetrates the cells of the rete malpighü, and gradually destroys the cell-protoplasm, pushing the nucleus to one side.

Klein (Rep. M.O. L. G.B. for 1892 -- 93) has described a peculiar extremely minute bacillus (0 ◦4 min. in length to 0◦3 min. in width), or rod-shaped micro- organism, as occurring in calf lymph and in human variola lymph during the early phases; in the former 72 to 96 hours after cavvination, in the latter during the third or fourth day. In the bacilli, when abundant, forms were recognised in which some globules resembling spores existed. Calf lymph of later stages - 5 or 6 days old - showed no bacilli or only here and there a trace. The presence of these spore-

like

bodies and the absence of bacilli in the lymph of later stages led Klein to conclude that in smallpox and the vaccine disease we have to deal with a spore-forming bacillus. The bacilli multiply in the early phases, spores are then formed, and it is these which prevail in the lymph of the later phases. This would explain the preservation of the active principle of vaccine lymph in glycerine, which is the germicide for cocci and sporeless bacilli, but not for spores. It would explain the continued activity of vaccine lymph dried on ivory or bone points, for such prolonged drying would kill all but spores. Klein's researches have been confirmed and his views have received independent support from Copeman, and the bacillus in question gives great promise of being the special organism of the disease.

Buttersack (Cited by Immermann, Nottmagels' Encyclopaedia of Pract. Med., 1902) has described certain threadlike structures and round bodies, resembling spores in vaccine lymph. These are, however, regarded as artificial.

Funk (Deut. med. Woch., Feb. 23. 1901) found protozoan, which he termed the "Sporidium vaccinate", -- probably the same organism previously described by Pfeiffer, -- in all vaccine pustules examined. They are usually from 1 min. to 3 min. in diameter, and larger cyst-like bodies filled with spores also occur.

Iskigami (Jour. Amer. Med. Assoc., Dec. 6, 1902 Bei - i. kwai, Tokio, xxi) has also discovered protozoa in the epithetical scales of the vaccine pustules, lymph, etc. He claims that the evidence is all in favor of the assumption that these sporozoa are the causa causano, existing cause, of smallpox.

Haushalter and Etienne (Saunders' Year Book for 1899) consider the haemorrhagic symptoms in variola due to secondary infection with the streptococcus, since they have found this organism in the blood of those who have died of the haemorrhagic fom of the disease.

In 27 fatal cases Sugg and Waele (Arch. internat de Pharmacol. et de Therap., xii, Nos. 3 and 3) found streptococci in the blood and regard these organisms - which are agglutinated by the serum of vaccinated persons - as the origin of the disease.

Councilman (Boston Med. and Surg. Jour., April, 30, 1903) points to organisms of the order of Protozoa a as causual agents in variola. He believes that they pursue a couble life-cycle within the cells, one phase being extranuclear, the other intranuclear, and the latter as analogous to the sexual cycle of the malarial parasite.

Calkins (Jour of Med. Research, Feb. 1904, p. 136) admits that these organisms are protoxoa. These are usually regarded as identical with Guarnieri's Cytoryctes, and are said to appear first as small

homogeneous bodies about 1 min. in diameter, in the protoplasm of the cells. They quickly increase in size, and coincidently the cell seems to undergo a process of degeneration. As they enlarge, the parasites become granular in appearance and irregular in outline; and finally they break up into a number of still smaller fragments, which are regarded as spores. These proceed to invade the nuclei of the cells, which have so far escaped. As the invaders once more enlage, the nuclei, are in their turn destroyed, and the parasites are set free. A second division into minute fragments may take place. These free bodies are supposed to be the infective agents by which the disease is communicated to other persons. It is suggested that vaccinia represents the extranuclear phase of the organism, whereas smallpox consists essentially in the invasion and destruction of the nuclei. If these observations are confirmed, the discovery will be of great interest; for then (1) we shall have an instance of the attenuation of a protozoan parasite taking place by passage through another animal, just as occurs in the case of bacteria (2) it will be demonstrated that an organism can undergo two different cycles within the same snimal host, but in different positions - cell and nucleus; (3) a vaccine will have been prepared against a protozoon as well as againt bacteria, showing that the human body has the power of forming protective substances against this order of pathogenic agents, as well as against vegetable organisms. Ledoux - Lebard (Comptes Rendues de l'Acad. des Sci., 1902) states he has prepared a specific antiserum to the protozoon organism, Peramoecium caudatum, which is pathogenic to some of the lower animals, as rabbits and guinea-pigs.

PREDISPOSINA CAUSES.

Receptivity.

Since the time of its recognition, smallpox has sooner or later found its way to all countries of the globe. Differing from most other epidemic diseases, variola exhibits slight dependence upon conditions of soil or climate. It breaks out where predisposed individuals are exposed, under especially favourable circumstances, to the influence of its contagion. Certain geographical peculiarities of the disease have become greatly, if not entirely, obscured since vaccination came to be adopted. The disposition of smallpox is of very general prevalence. Individuals who can boast of an absolute immunity from the disease are quite exceptional. The three distinguished physicians Morgagni, Diermerbroeck, and Boerhaave, it is said, could claim this peculiarity. In our day, when vaccination and revaccination afford such powerful protection against the disease, we have fortunately but limited means of observing the conditions which the records of former centuries depict. It may be said that one attack confers permanent immunity, but exceptionally a second or even a third may occur. Vaccination also, if successful, affords future protection against variola; there are, however, frequent exceptions to this rule.

Age.

The disease affects individuals of all ages, In this respect smallpox shows itself far more independent than the majority of acute infections, diseases, although a fully similar relation to all periods of life is nowise to be affirmed. In the earlier months of life the disposition appears to be less than after the first year. From that time until the age of forty years it is most strongly manifested, and tolerably equally throughout that period. Even from this age until sixty, the malady is frequently observed, and in extreme old age it has been frequently encountered. Even life does not exclude the danger of smallpox infection, although the predisposition of the foetus is far less than that of the child during the first few months after birth, and it may be included among rare occurrences for a child to come into the world already ill with smallpox, or with of having gone through the disease. Under what conditions an infection of the embryo takes place is wholly unknown. A priori, one would imagine that in consequence of the close relationship of its blood to that of the mother, the foetus would pass through

all the phases of the disease coincidently with her. Strange to say, however, this appears to be of uncommon occurrence. In most of the reported cases the infection of the embryo appears rather to have taken place at a later period than that of the mother - pustular stage - which would indicate infection by simple contact rather than by the blood. This is quite in accord with the assertions of older authors that infection takes place most readily when the liquor amnü is present in minimum quantity. Were the blood of the mother the principal infecting agent, the disease in the foetus would be of decidedly more frequent, if not of constant occurrence; for at no other time of life do so absolutely favourable conditions for determining infection The disease has been observed as early as the fourth month of embryonic life. Cases now and then appear in the literature of perfectly healthy mothers - not attacked by smallpox during pregnancy - who have given birth to children affected with variola. It has usually been concluded that the embryo has been directly affected through exposure of the mother, who at the time was not personally susceptible to the contagion. The possibility of such occurrence is not to be excluded. Some of these infrequent cases, however, might be explained upon the hypothesis that the mother suffered from "smallpox without eruption", and thus infected the child. Such a connection would be the more readily overlooked, because the foetus does not suffer simultaneously with the mother, and the mild and rapidly progressing disease in the mother might be mistaken, or long forgotten before the birth of a child bearing the smallpox. Even then most babies who are exposed to the virus at the time of birth, of if immediately and successfully vaccinated, will not take the disease.

Sex.

On the whole sex appears to cause no appreciable difference in the susceptibility to smallpox, although in the reports of the metropolitan Asylums Board show males slightly in excess. This is doubtless due to the greater exposure to infection on their part. Under similar conditions , men and women are liable to the disease in the same degree. In women pregnancy and childbirth, would seem to cause a certain predisposition to variola, and also to its greater malignancy. This predisposition is counterbalanced in men, however, because their vocations cause them to be far more frequently exposed to the danger of infection than women, who stay at home. MacCombie (Art. "Smallpox," Allbutt's System of Medicine) gi ves the following table, showing the sex and number of smallpox patients at different

quinquennialls up to twenty-nine years of age (Metropolitan Asylums Board Reports);

Age	Male	Female
Under 5 years.....	799	717
5 to 9	1.211	1.209
10 to 14	1.659	2.029
15 to 19	2.389	2.087
20 to 24	2.206	1.556
25 to 29	1.337	941
30 years and upwards.	2.075	1.482
Total	11.676	10.021

Race

Negroes, possibly in consequence of tendencies inherited through generations of unvaccinated ancestors, are particularly prone to smallpox. They usually suffer more violently from it than white races even under exactly the same conditins, no matter in what part of the globe residing. The native Indians of America are said to be just as prone to variola as the African blacks. From its first introduction amongst them by the Spaniards until now the disease has exterminated whole tribes of Indians. With them it thrives at a low atmospheric temperature.

Season of the year.

This has a marked influence on the development of smallpox. Whilst outbreaks may occur at all seasons of the year, they are chiefly seen in Autumn and early spring and mid-winter. In this country and Western Europe generally the monthly morbidity is high from November onwards; but from May a rapid decline in the prevalence of the disease takes place, September showing the lowest morbidity. Variola is, therefore, as much a disease of winter and spring as typhoid fever is of the autumn. In tropical countries smallpox is more prevalent during the hot weather and least so during the tropical winter months. Authors are not in accord as to whether the deficient ventilation occasioned by cold weather is responsible for the increased prevalence. In Norther Europe and North America the disease thrives best with the temperature below 50 °F.

Associated with other diseases.

It has been frequently asserted that existing diseases lessen the disposition to smallpox; a proposition which allows of no such gerneralisation. The great majority of chronic diseases appear to exercise little or no influence upon the susceptibility of variola. Thus patients with herts, lung, and abdominal affections, are attacked during an epidemic, and as often, if not more so, than healthy persons. So, too, lunatics

and sufferers from chronic skin diseases, are apparently no less seldom infected. With acute affections, especially with the acute infectious diseases, it appears to be otherwise than with the chronic diseases. As regards the acute exanthemata, especially scarlet fever and measles, their concurrence with smallpox was formerly much more frequently believed to exist than was really the case, inasmuch as the so-called prodromal eruptions led not infrequently to an erroneous belief in such combinations. Indeed, within recent times this error is not always avoided. It would be going too far to consider all recorded cases of the simultaneous existence of smallpox and some other acute exanthem as such interchanges. At present it may be taken as proven the possibility of the simultaneous affection of an individual with smallpox and with measles, or scarlet fever. The occurrence, however, is very rare, and diagnosis extremely difficult. A coincidence of smallpox and typhoid fever was established by Simon (Berl. klin. Woch., No. 11, 1872) who described a decisive case observed during the simultaneous existence of an epidemic of typhoid fever and variola. Simon states that in many cases of typhoid fever and more marked development of the roseola became noticeable under the influence of smallpox.

Mac Combie (loc. cit. p. 212) states he has not seen a single instance of the coexistence of variola with any of the acute infective eruptive diseases.

The writer has never encountered smallpox in connection with other exanthemata, although it has been seen to occur in association with syphilis, acue, psoriasis, and other cutaneous affections. As a rule , variola in syphilis pursues a mild course.

Rosenstein, and others assert that influenza, malaria, and whooping-cough lessen the possibility of infection with variola.

THE CONTAGION; MODES OF CONVEYANCE AND INFECTION.

Although the contagious nature of smallpox was recognised at a very early period, we are indebted to Boerhaave (Van Sweiten: Commenteria in H. Boerhaave Aphorusmos, tome v, Lugd. Bat. 1772) for the overthrow of the most varying ideas then prevalent, and the establishment of the theory of the exclusive spread of smallpox by contagion, which to-day we reagrd as firmly grounded. Reasoning by analogy we believe that the spread of smallpox occurs exclusively by means of a specific micro-organism which exists in the vesicles, pustules, crusts, and is probably carried off by currents of air, so that infection may take place at a distance, from the body. Inoculations of blood, urine, faeces and saliva from smallpox patients have been made with negative result.

The contagion is principally contained in the smallpox pustules as is clearly proven by inoculation from these; as is also the fact that the poison is most active at the time when the vesicle becomes a pustule. That inoculations succeed in the later stages also, is well known. Even the smallest crusts are highly infective, so much so that they were formerly used in China for inoculation in the nasal cavity. Even in more modern times powdered smallcrusts were recommended by Gatti, and others as the most convenient means of inoculation.

It is highly porbable that the blood of smallpox patients contains the virus in a high degree of activity. Direct inoculatory experiments upon men, upon which our forefathers in medicine relied, are illegal in the present day, since inoculation has been supplanted by vaccination; and, therefore, unless proven by accident, the problem must go unsolved. As regards experiments upon animals, Psiander was able to inoculate healthy sheep successfully with the blood of other sheep affected with smallpox. Zülzer inoculating the blood of a variolous patient with a monkey, was able to reproduce the disease.

Not only does the contagion adhere to the patient himself, but it is also present in his immediate vicinity. It appears to be secreted by the skin especially. Whether the frequently noticeable peculiar odour of the patient is closely related to the contagion, as was formerly believed, is not decided. In general it can be said that the contagion loses efficacy with increasing distance from the patient. Predisposed persons are the more readily infected the longer they remain in the vicinity of patients, the smaller the apartment, and the greater the number, and severity of the cases occupying it. In large spacious apartments with few patients, or but one, the danger is slgihter; it is even more decreased in the open air. Much attention has of late been given to this important question of aerial dissemination of smallpox. Power (Supplement to the Local Government Board's Annual Report, 1880 - 81; 1884 9 85 - 86), Barry (Report of an Epidemic of Small-pos at Sheffield, 1887 --88, 1889), Evans (Brit. Med. Jour., 1894. ii , p. 356 -558), and others more recently , maintain that the infection of districts surrounding smallpox hospitals bears an inverse ratio to the distance from the focus of contamination. Some, however, - with Savill (Brit. Med. Jour. 1897, ii, p. 1680) and Seaton (Ibid. 1896, i, p. 582) -- affirm that aerial transmission can be disregarded in this disease.

Winter Blyth (Manual of Public Health) states that the usual spread of smallpox is from person to person, but still it can "strike at a distance" and travel far. Further the influence of the Sheffield hospital (epidemic of 1887 - 88) could be distinctly

traced for a circle of 4000 feet; for instance, the late Dr. F.W. Barry, Inspector of the Local Government Board gives in his report the following percentage of households attacked at successive distances from the hospital;

0 - 1.000 ft.	1 - 2.000 ft.	2 - 3.00 ft.
1.75	.50	.14

3 - 4.000 ft	4.000 ft.
.05	.02

Evans (the Aerial Convection of Smallpox, Bristol Meeting of the British Medical Association, 1894, Section of Public Medicine) from his personal observation of an outbreak at Bradford in 1893 confirmed the conclusions arrived at by Barry; stating that between January 14th and December 30th, 1893, 626 houses became newly invaded by smallpox within a mile of the Bradford Fever Hospital which was used during the greater part of the year named for the isolation of variolous patients. The hospital is pleasantly situated on an eminence on the eastern side of the town at an altitude of some 400 feet above the level of the sea. It covers about 11 ½ acres of ground. The one mile area round the hospital contains over 17.000 houses. Of the 626 houses newly invaded, 162 were situated under a quarter of a mile from the hospital, 242 withi n a ring between a wuarter and a half of a mile distant from it, 163 in a ring within half a mile and three-quarters of a mile, and 59 in a ring within three-quarters of a mile and one mile from the hospital. The rate of incidence of smallpox on 100 houses in the whole borough was 1.6; in the special area bounded by a circle of one mile radius from the hospital, 3.6; in the other parts of the borough outside the special area, 0.6. The rate on the total houses within a mile of the hospital having been 3.6 per cent., it was 10.4 per cent. within a quarter and half a mile distance, 2.1. per cent. within half a mile and three-quarters of a mile, and only 1.0 per cent on houses within three-quarters of a mile and one mile distance from the isolation hospital. Evans believed that the most likely way to account for the extensive prevalence of smallpox over the special area described is that the poison was conveyed aerially direct from the wards of the hospital. A study of the direction o f the the prevailing winds throughout the year 1893 supplies strongly confirmatory evidence of this view. Evans, in order to demonstrate the influence exerted by the wind in determining which side of the hospital received for the longest period the infected air from the hospital wards, divided each quarter-mile zone of the special one-mile area into quadrants, by drawing radii to north and south, to east and west. He thus ascertained the percentage of infected houses

in each of the four quadrants lying respectively northeast, northwest, southeast, and southwest of the hospital. The results are striking. In the northwest quadrant , 7.06 per cent. of the houses were infected; in the northwest quadrant, 2.40 per cent; in the southeast quadrant, 5.28 per cent.; in the southwest quadrant, 2.93 per cent. Furthermore , the percentage of infected houses in the special zone to the east of the hospital amounted to 5.6. per cent., as compared with 2.9 per cent. on the west side. These facts are explained on the ground that on 250 days of the year the prevailing winds were westerly and only on 83 days was the wind persistently from the east. During the first half of the year, when easterly winds were more common than during the second half, the proportion of cases occurring on the western side of the hospital was relatively greater than during the remainder of the year, when there was a lesser frequency of easterly winds.

Savill, in studying the diffusion of variola in two buildings in which there were 1076 persons adjoining a smallpox hospital, found that in 10 only was the source of infection other than direct exposure or contact. The epidemic continued nine months , and Savill remarks that the air, being in itself a bactericide, debars him from believing that the smallpox virus is infectious beyond the confines of a room.

Infectious Period.

It is doubtful at what stage of the disease the greatest infectivity exists: it is usually believed to be at the earliest period of suppuration. Many ascribe a special infectivity to the stage of dessication. When there has been frequent communication with patients, the time of infection, owing to the variable duration of the incubatory stage, cannot be accurately determined. In the initial stage, moreover, at a time when as yet no trace of the characteristic eruption exists, infection may take place; and this is also possible during the period of incubation. The frequent cases in which patients are unable to indicate to source of infection, not having come in contact with any variolous person, are in part referable to incubation during the initial stage. Schaper (Deut. Militair. Zeit; 1872, p. 53) describes a case proving the possibility of transferring the disease during the period of incubation: In the Charité Hospital of Berlin small pieces of skin were taken for transplantation upon other individuals from the amputated arm of a person who, before and at the time of the amputation , did not manifest the slightest symptom of general disease. Several hours after the amputation the patient was attacked with violent fever,

followed two days later by an eruption of smallpox. One of the individuals upon whom the transplanted skin had been placed was attacked by smallpox six days after the operation, but the disease did not attack the other three.

Heberden (Commentaries on the History and Cure of diseases, 1803) states that he has met with many instances which show that one who has never suffered from variola may safely associate and even lie in the same bed with a smallpox patient for the two or three first days of the eruption, without any danger of receiving the infection. He narrates how one woman continued to suckle her infant for two days after the smallpox had begun to appear upon her and the child being then removed escaped the disease for that time; but, as it took variola about eighteen months later, it was unquestionably capable of being infected.

Infection through Dead Bodies.

Infection can undoubtedly take place through the medium of the bodies of patients who have died of smallpox. Sir Thomas Watson (Lectures on the Practice of Medicine) exemplifies this possibility. Thus the corpse of a man who had died of variola was brought into a London dissecting room, with the result that four students of the practical anatomy class took the disease, although the cadaver had only been touched by one of their number.

Infection through clothing, etc.

It is a fact well known that the contagion can adhere to certain objects which have been used by the patient or been in his neighbourhood, and that it clings to them for a variable period after they have been removed from the room. Foremost in this respect may be mentioned clothing and bedding. The personal effects of a patient are not only able to convey infection, but healthy persons also, under some circumstances, carry the poison in their clothes, e.g., physicians, nurses, etc. Hewitt (Section of Preventive Medicine, Seventh International Congress of Hygiene, London, 1891) has described a remarkable case in which a female immigrant attended a smallpox patient on board ship while crossing the Atlantic from Liverpool to New York, then took off and put by her clothes, which she again began to wear, some time afterwards while attending a sick child in a distant part of the country, with the result that this child soon fell ill with smallpox, the disease spreading until the fatal cases numbered one hundred. All the woman, whose clothes spread the disease, remained free from the disease and quite healthy. A still more striking case is recorded by Osler illustrating the rapid

spread of variola; It appears that smallpox had been prevalent in Montreal between 1870 and 1875. It died out in the latter year, and the health reports show that the city was free from it until 1885. During the interval vaccination , to which many of the French Canadians are opposed was much neglected, so that a large unprotected population grew up. On February 28th, 1885, a Pullman car conductor, who had travelled from Chicago, where the disease was slightly prevalent, was admitted into the Hotel-Dieu, Montreal, the civic smallpox hospital being at the time closed. Isolation was not carried out, and on April 1st a servant in the hospital died of smallpox . After her death the hospital authorities, dismissed all patients showing no signs of infection and who were able to go home. The malady spread with alarming rapidity, so that within nine months e, 164 persons died of smallpox in Montreal among a total population of 200.000.As a striking instance of the vitality of the virus, a smallpox is recorded by Buck; In 1876 a child contracted variola in a house in New York. After the patient's recovery the carpets were removed, the walls were whitewashed, and the room was carefully disinfected. New tenants shortly afterwards took possession of the room, and two years later a child was born (1878) When two months old, being still unvaccinated, she became ill and soon presented all the symptoms of smallpox.

Epidemiology.

One may observe smallpox in all possible grades of intensity, and extent, from sporadic, domestic, or small epidemics, to the pestilential form which overruns entire countries, and is not checked until it has attacked nearlyall who are predisposed . In large cities it is seldom for long entirely absent, isolated cases being almost constantly observed there, which may spread at any time under favourable circumstances. The danger, has, however, diminished a great deal since the introduction of vaccination.

In former times attempts were made to prove that smallpox exhibits a periodicity in the return of its epidemics; thus it has been said to return every twelve or fifteen years. This theory is now regarded as entenable, and apparnetly gained support from the simple observation that fluctuations have occurred in the recurrence of the disease, so that periods of rest have alternated, with some uniformity, with years of great prevalence. One attack of smallpox protects a person for life, or at least for a long time, and vaccination exerts the same effect also, although it is of shorter duration. In a population, then, where as many individuals as possible are subjected to these favourable influences -- and in

vaccination also we have a sure means for its accomplishment -- the chances of the disease taking a firm hold and spreading become extremely slight. But when this immunity has lasted a certain time, and vaccination has come to lose its effect, then the susceptibility of those previously protected becomes gradually re-established. To this number still others are gradually added, who have neither passed through the disease nor been vaccinated. In this manner the fruitful soil is again provided upon which the contagion only needs to work yo give speedy rise to a scourge of mighty dimensions. If such an epidemic is finally extinguished, all the predisposed among the community have usually been attacked , and thereby become exempted again for a long time. Moreover, the second important factor, vaccination, is more carefully performed under fresh influence of fright, which attends the visit to a locality of a smallpox epidemic, and this likewise protects for a long time afterwards. Meanwhile the soil for the contagion becomes barren.

PATHOLOGY AND MORBID ANATOMY.

SKIN.

The first appearance noticed is that of circumscribed patches of hyperaemia, to which the papillary layer of the corium is concerned, and which is followed by some thickening of the rete, the epithelia involved becoming coarsely granular. This granular condition is due to an increase of living matter within the protoplasmic bodies, evident at the points of intersection of the reticulum of which they are composed, the nuclei becoming solid and shinning and the threads traversing this cement-substance between them becoming also increased in thickness. The papillal beneath increased in size in consequence of their vascular engorgement, and in consequence of the change experienced by the connective tissue bundles, which are partly transformed into protoplasm, while the protoplasm between them increases also. In short, there is a liquefaction of the glue-giving basis-substance, which makes visible the reticulum of living matter formerly hidden within it. In this way the epidermis is raised into flat solid papules, which are the early lesions of the disease. Then follows an exudation of serous fluid at one or more points in the papule, the meshes of the reticulum being so stretched and torn, that small chambers are formed, filled with the liquid exudate containing granules. Between these chambers the separating strata of epithelia are compressed , so as to form septa or partition walls. The neighbouring epithelia become granular, divested of their cement epithelia, and transformed into protoplasmic clusters still connected with the living reticulum by slender threads. An irregular cavity is thus formed in the thickened rete traversed by septa, the contained exudation being filled with granules, coagulated fibrim and lymph. A few protoplasmic bodies are here also distinguishable, which Heitzmann (Trans. Amer. Dermat. Assoc., Aug. 1879) regards as either debris of destroyed epithelia or lencocytes. The connective tissue beneath participates in these changes. The papillae eventually disappear, the superior portion of the corium being replaced by clusters of medullary or inflammatory elements uninterruptedly connected by threads of living matter. The pus-corpuscles which eventually appear originate mainly from the transformed epithelia. In the process of transformation the increased protoplasm of the epithelia first exhibits skining homogeneous lumps, which, after an intermediate stage of vacuolation, undergo an endogenous metamorphosis into nucleated bodies

with a reticulum in each. To the number of each there is possibly an addition by the immigration from below (diapedesis) of lencocytes. The question of repair with or without the production of cicatrices rests upon the behaviour of the connective-tissue elements. If these are not torn asunder, but remain in connection with each other, the re-formation of a glue-giving basis-substance is possible, and new bundles of fibrous connective-tissue take the place of the old. If , on the contrary, the latter are completely destroyed, their place is filled with the cicatricial new growth. The pigmenlation, which is such a common transitory sequela of the cutaneous lesions, is due both to the imbibition of the colouring matter of the blood by the epithelia and by direct haemorrhagic exudation into both rete and derma. The umbilication of the mature pock is perhaps due to the situation of such lesions at the orifice of the excretory ducts of the glandular structures of the skin. The epidermis, in one or more of its strata, dips downward to form a living investment for such glands, and in this situation ties down the centre of the roof-wall of the pustules. Eventually, it too, as a result of the maceration and tension incidental to the complete filling of the pock with pus-elements, is ruptured or stretched, with the result that there is a disappearance of the umbilication. The anatomy of the cutaneous lesion in haemorrhagic smallpox is similar to that described above. The pocks in such cases are merely filled with blood instead with pus or sero-pus. In some forms of haemorrhagic variols, as indeed would be suggested by their clinical observation, there is haemorrhage directly into the tissues of the integuments, or, more probably in severe cases, a mere passive leaking of the sanguineous fluid with its colouring matter vascular walls already in a weakened and relaxed condition.

The morbid changes occurring in the skin are described by Hilton Fogge as follows; The papule of smallpox, unlike that of measles and most other exanthemata, results from a definite change in the superficial and middle cells of the rete mucosum, which are swollen and opaque from the very commencement of the pathological process; in their midst there is speedy exudation, so that a minute conicle vesicle is formed at the end of two days by elevation of the horny layer of the epidermis. Then follows the formation of the pustule by a process of cell proliferation; a central depression (the umbilicus) develops, at the bottom of which the opening of a hair follicle is frequently found, this fact, moreover, suggesting an explanation of phenomenon of umbilication so eminently characteristic of the

the disease. This explanation does not, however, always appl y for the reason that the pock does not necessarily bear a definite relation to any of the cuticular canals. A similar function is then probably discharged by one of the many other bands, which cross more or less verticle, dividing it into a number of separate chambers or loculi. This loculated character of the affords the reason why only a small part of the fluid is evacuated when a needle is introduced into the roof of a single spot. The septa in question are in reality formed out of the single cells of the rete mucosum, small bundles of which adhere together, and become stretched out into filiments and bands, as the exudation accumulates round them. In this fluid lencocytes are present in small number from the very first; they go on increasing, and it gradually passes from the transparent serum into opaque pus. The change is completed in six or seven days from the first appearance of the exanthem. The pathological changes in the skin are by no means confined to the epidermis; for the papillary layer of the derma is also the seat of a variolous inflammation, and it extends sometimes through the whole thickness of the skin. The exudation which fills the vesicle, and afterwards the pustule, is derived from these hyperaemic tissues. Some of the papillae are flattened by pressure and pass into a state of permanent atrophy, but others are infiltrated by lencocytes to such an extent as to obliterate their nutrient vessels and so destroy their structure, converting them into a white or ash-gray substance.

Unna (the Histo-pathology of the Skin) states that the epithelium in the upper prickly layer of the rete mucosum softens and becomes oedematous from swelling of the protoplasm within the epithelial cells, while a secondary coagulation of the albuminoid bodies set free from the epithelial protoplasm takes place, constituting a fibrinoid degeneration of the epithelium. In smallpox this advances more slowly than in chickenpox, and is quickly followed by suppuration. This arises partly from intense inflammation, partly from a secondary infection of the skin by pyogenic organisma. Owing to the slow advance of the colliquation or softening of the prickle cells, other epithelial cells are compressed into trabeculae oe septa, perpendicular in the centre and directed somewhat outwards at the side. The younger epithelial cells of the lower prickle layer meanwhile assume the form of hollow spheres or ballons. Unna accordingly describes the fibrinoid degeneration of the epithelium in smallpox as presenting two forms- reticulating colliquation (or softening) and ballooning

colliquation. The first predominates at the periphery of the pock, the second at its centre. In the vesicular stage umbilication is due partly to reticulating degeneration, partly to epithelial oedema. Of these, the former is especially developed at the periphery of the pock; the latter is always confined to the periphery. The less swollen centre, where ballooning colliquation predominates, simply remains behind. Unna admits that, where a hair follicle accidentally runs through the centre of the pock, a form of depression may be produced , for the swelling of the prickle layer will here be limited by the cornified neck of the hair follicle. But the exceptional case does not explain the characteristic central depression of the smallpox vesicle, to which the term umbilication is applied. This depends on the two changes in the periphery of the pock which have been mentioned - reticular colliquation and oedematous swelling of the epithelium, while ballooning degeneration or colliquation leads only to a very slight increase in the centre of the vesicle, with the result that the periphery is prominent, the centre depressed and apparently retracted. From the fifth day onward the blood-vessels throughout the cutis are dilated. A full stream of lencocytes causes an ever-increasing infarction or plugging of the vesicle or pustule, which is thus converted into an almost solid tissue, or, if the horny layer of the cutis yields, a more or less profuse suppuration lasts for a time or speedily ends in the formation of a crust or scab. When the scab is thrown off, a persistent trough-like depression is displayed. The depth of the scar depends on the degree and the duration of the flattenting of the base of the pock beneath the pustule and the scab. In view of this, Unna holds that the rational treatment to avoid scars should be mainly directed to prevention of a pustular stage and the rapid removal of the scab by a plentiful growth of new epithelium.

Weigert (Arch. f. Path. Anat., vol. lxix, p. 409) , and others regard the cutaneous lesions of smallpox as of the nature of a coagulation- necrosis; but their theory is negatived by the fact that the nuclei are the last portions of the cell to be affected, and also that necrosis does not occur en masse. Renaut (Ann. de Derm. et de Syph., 1881, ii, S., ii, p. 1) refers the lesion to a cloudy swelling. Leloir considers the process an "alteration cavitaire."

" M U C O U S M E M B R A N E S.

Autopsies of smallpox patients show that the mucous membranes have during life suffered less than the skin. Those

which are most exposed to the external air are usually affected, and often present well defined lesions, while the lining of the respiratory and digestive tracts may show no traces of infection, even when the cutaneous rash is very abundant and pustular. Generally speaking, the lesions in the mucous membranes are in direct relation to the extent and intensity of the cutaneous lesions. In confluent smallpox pustules are frequently found in the trachea as far as its bifurcation, it may even be as far down as the second and third branches of the bronchial tubes. In the haemorrhagic forms there are likewise marked evidences of congestion, and yellowish exudation, with an abundance of blood mucus, is seen. Similar changes are often observed in the gastro-intestinal tract. Pustules may be found in the upper portion of the trachea and in the lower part of the rectum, with catarrhal inflammation and small haemorrhages in the stomach and intestines. Sometimes the mesenteric glands swell and suppuration occurs in the lymphoid follicles of the intestine. Pustules are sometimes found at the meatus wimarius, and marked congestion of the urinary tract may be observed. Both bladder and urettis appear to escape having an eruption. In haemorrhagic smallpox, both mucous and serous membranes show ecchymoses and extensive haemorrhages, and the stomach lining and loose connective tissue of the thorax does not escape.

I N T E R N A L V I S C E R A.

The liver, spleen and kidneys are chiefly affected. In haemorrhagic smallpox , especially the purpuric form, the viscera are found engorged with blood but no more as the disease is so speedily fatal. When death occurs later, the liver, kidneys, spleen and heart muscle are found to have undergone important changes.

According to Ponfick (Berl. klin. Woch, 1872, No. 42) the spleen greatly enlarges, its pulp becomes soft and of a light red colour, in those who die early in the disease, It subsequently resumes its normal appearance except in purpuric variola, when it may be found small, hard, of a dirty red colour, with sometimes large yellowish or white follicles.

The heart muscle is yellow, flabby and brittle when the degeneration of the kidneys is far advanced; but in purpuric smallpox the heart is often found brownish-red, firm and contracted.

The kidneys and liver are sometimes the seat of cloudy swelling (granular degeneration), sometimes of acute fatty degeneration, resembling that produced by phosphorus poisoning; the latter is the more advanced condition in which the former may terminate.

Cases which die very early or late in the disease may not show these changes.

The bile is as a rule more pale and thinner than in health.

S Y M P T O M A T O L O G Y

V A R I O L A V E R A.

This is the ordinary or regular form of smallpox running usually a uniform clinical course, and may be regarded as the ideal from which proceed other types and minor clinical forms. Again, under this heading it is convenient to describe a discrete and a congluent form, according to the distribution of the eruption. In the former the pocks are sparsely scattered over the body, in the latter they are arranged in large blister-like areas. Further, the eruption may be congluent on certain parts and discrete on others, in which case the condition is eometimes described as semicongluent variola, Lastly, in rare instances, the cutaneous lesions may present a marked tendency to form groups or clusters on various parts of the body, constituting the corymbose form of smallpox.

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(A) DISCRETE FORM (Variola Discrete vel Distincta).

STAGE OF INCUBATION.

A certain time elapses, from the moment of reception of the variola contagion until the subsequent outbreak of the disease, during which the individuals, as a rule, present no abnormal symptoms, subjective or objective; or merely make some vague, insignificant complaint. This is the period of incubation. Concening its duration we are better informed than in other acute exanthemata, for the reason, perhaps, that it exhibits greater regularity in this respect. It is, therefore, fairly constant and is usually from ten to thirteen days, less frequently fourteen days, or eight or ten days, very rarely only five days. Its average duration is twelve days inclusive, except in cases of inoculation, when it is nly eight days, or even as short as forty-eight hours. By inoculation is understood the engrafting of the disease by introducing its contagion directly into the body through puncture of the skin or by abrasion of a mucous membrane; e.g. by vaccination in the former case, and the use of a snuff of highly dried smallpox crusts by the Chinese, in the latter. Zuelzer found the stage of incubation in haemorrhagic smallpox to be considerably shorter than in pustular variola - viz;

six to eight days in nine cases.

Usually there are no symptoms in this stage; but in rare cases certain vague feelings, such as langour, pain in the head and back, or slight gastric disturbances are observed. Scheby - Buch saw the stage of incubation accompanied by symptoms in about 4 per cent. of all his cases. Obermeier says he has sometimes noticed in the last days of this stage a pharyngeal catarrhal, with redness and swelling o f the tonsils and uvula. This observation is interesting. The lymphatic structures in these parts may be regarded as the first line of defence against a bacteria invasion. It is in the tonsils, and in those areas of lymphoid tissue which have been called the lingual and the pharyngeal tonsils, that the earliest encounters between the invading germs and the defending microbes take place, with resulting hyperaemia and inflammation.

I N I T I A L S T A G E (Stage of Invasion; Stadium Prodromorum).

The commencement of the initial stage is usually marked by a violent rigor, or several chills, usually of slight intensity, repeated at certain intevals. Fever is thus ushered in, usually lasting until the eruption appears, and in isolated cases of varying intensity; but sometimes so severe that in conjunction with the other symptoms a picture of disease is presented severer and more serious that almost any other which acute affections could present. The temperature of the body during the first day rises to 102° or 103°F., without remission on the following morning, and toward the evening of the second day 104F. or in the more severe cases 105°F. may be reached. The highest temperature may be observed just before the eruption comes out, and usually on the evening of the third day of the disease. Few febrile diseases present the sudden rise of temperature seen in variola. In mild cases it continues until the eruption appears, when its decline is equall y rapid. The temperature seldom returns to normal during this stage, and its fall in severe attacks is slower and more irregular.

In robust subjects the pulse is usually full, and tense, and generally corresponds in frequency with the temperature of the body, so that the curves of both run approximately parallel. Even in powerful men it is seldom under 100; usually it is from 108 to 120; in women frequently 130 to 140; and in children as rapid as 160. In severe cases it may be soft and discrotiç,as in typhoid fever.

The rate of respiration is almost always considerably increased. The respirations are short and laboured; and many patients actually complain of dyspnoea; although the most careful examination reveals no essential change in the respiratory or circulatory apparatus, It is of the type known as "cerebral

respiration." said to be induced by the sharp rise of temperature and by the combined morbid influence of the smal lpox poison and the superheated blood upon the respiratory centre.

Out of all proportion to the degree of fever is the langour and weakness of the patient, and even the most powerful patients are scarcely able to stand out of bed; they are unable to take even a few steps without support. The face of the patient appears sunken and pale, the features expressionless, the extremities cold, the pulse small and of great frequency; and the patient is very dizzy. When the patient is observed in bed quite a different picture presents itself. The eyes are dull, the skin is dry and hot, the face is flushed, and the carolids throb; so that many patients are scarcely to be recognised when seen in bed with the red turgescent countenance.

The skin feels dry and hot in most cases; it may, however, be cwered with a moderate perspiration, said to have a peculiar "specific odour."

Severe thirst is usually complained of, and the lips and tongue are parched. The latter is nearly always covered with a thick yellow fur, and the odour of the breath is extremely offensive.

Smallpox patients lose their appetite entirely in this stage, and nausea and vomiting are frequently observed. The vomiting may continue throughout this stage and be of a bilious character, more especially in the haemorrhagic variety of the disease, where also there may be severe pain in the epigastrium.

Constipation is seldom absent at this stage, and often last throughout the ntire attack. Diarrhoea, however, is by no means rare in children, but quite exceptional in adults.

Severe frontal headache is another symptom rarely absent at this stage. It appears, as a rule, shortly after the chill, or simultaneously with it; or it may precede this a few hours associated with pain in the back, etc. It either continues unchanged during the whole initial stage, or, as is more common, gradually subsides as the eruption approaches. Meanwhile the headache is excruciating, often to such a degree that the patient moans continuously. Though usually frontal, it may involve the entire head. Patients describe this pain in the most varying manner; as if a rope tightly encircled the head, or as severe lacinating, throbbing pain, increased with every beat of the heart. The only febrile condition with which it is comparable is the onset of cerebral meningitis. The carolids show violent pulsation, the forehead is hot, and the face is usually red and bloated.

About the evening of the second or third day, patients may commence to talk incoherently; and may even fall into violent delirium. Short of this

restlessness xxx insomnia is uaually experienced.

In children coma may be seen; but more often convulsive movements, varying in degree from a sudden starting up or grinding of the teeth to actual convulsions. Trousseau (Clinical Medicine, 1873, vol.1, p. 65) regards this as a symptom of diagnostic value, while Sydenham states it occurs more frequently in smallpox than in any other exanthemata.

Vertigo is frequently complained of, and the patient may have a syncopal attack on rising from bed, or collapse entirely.

Pain in the back, corresponding to the lower dorsal, lumbar, and sacral regions, is experienced by all smallpox patients. This symptom has long been noted as a conspicuous feature of the disease, and the ancients attributed it to an "ebullition" in the great dorsal vein," while modern physicians regard it as resulting from congestion of the spinal cord. This striking symptom is, however, not always present. It usually appears at the commencement of the initial stage; sometimes it precedes , at other times it follows, the chill, and, as a rule, continues to the outbreak of the eruption. This symptom appears to be more constant in variola vera and in violent or haemorrhagic cases than in the milder forms of smallpox. When present this dorsal pain constitutes one of the principal troubles of the patient. When accompanied, moreover, with drawing tearing pains in the limbs, as is very often the case, it may erroneously be ascribed to acute rheumatism, especially in sporadic cases or the first cases of an epidemic. In pregnant women the pain in the back may be taken for labour-pains, and in those not pregnant it is often simply regarded as the precursor of the occurrence of menstruation.

One of the less constant symptoms is bronchitis It is more common in the eruptive stage. Existing respiratory troubles usually undergo a marked exacerbation.

In alcoholics and neurotic women, palpitation may occur now and then, without apparent cause; no important anomalies affect the heart, however, if this organ has been previously unaffected.

Sore-throat may develop towards the end of this stage. Swelling and diffuse redness of the tonsils and soft palate are usually apparent at this time, and, much less frequently, discrete red spots, are already apparent upon these parts. Most frequently the throat affections occur in cases in which definitely grouped pustular eruptions are established, later, upon the mucous membrane of the mouth and pharynx. Coryza sometimes appears in connection with the anginose symptoms, and with this epistoxis, photophobia, and lachrymation may also be associated.

In other infrequent cases various degrees of hoarseness are produced by laryngeal extension.

The urine in smallpox has no usual typical characteristics of fever. It is passed in small quantity, the colouring matters are increased, and the specific gravity is high. Relatively and absolutely, the urea is generally increased, but it may, rarely, be absolutely diminished; under such circumstances, leucin and tyrosin may appear in the urine instead of urea. The chlorides, sulphates, and phosphates are absolutely somewhat diminished. The uric acid is increased, and the urine, on cooling, frequently deposits amorphous urates. Albumin is invariably present in the urine of all smallpox patients, and it generally makes its appearance with the onset of the disease. The sediment contains renal cells, and a moderate amount of blood both free and adherent to the casts. An active hyperaemia, which is usually quite severe, is the rule. Occasionally, a true acute nephritis develops, especially in the malignant forms. The urine frequently contains bile pigment. In the haemorrhagic form of the disease haemoglobinuria may be a prominent feature of the urine. The haematuria accompanying an acute nephritis is frequently confounded with it; this error should be studiously avoided.

Obermeier, Zuincke, Scheby-Buch, Leo, and others have drawn special attention to the condition of menstruation in the initial stage of smallpox. At the beginning of variola, and especially at this stage, the menses set inwith striking frequency, whether before their time or at the regular period.

Initial Eruptions- -

During the stage of invasion there sometimes appear accidental or prodromal rashes (erythema variolosum. They are usually seen on the second or third day of the invasion of the disease. Too much attention can scarcely be paid to the importance of their recognition on the part of the diagnostician. Often indeed have physicians been deceived by their occurrence, having been either completely blinded to the serious nature of the malady in progress, or, as Bartholow 'The Variolous Diseases, Med. News, Mar. 4. 1882, p.232) has well shown, having supposed they were dealing with a concurrence of scarlatina, or rubeola and smallpox. Hbra was the first to point out the significance of the rash known as roseola variolosa or erythema variolosa. Occurring at about the dates named above, it is in a few patients pronounced and vivid, even in solitary instances rivalling in severity the exanthem which succeeds it. In others, the majority

of all patients in some epidemics, it may be entirely wanting. Its most typical development is observed in women who are either menstruating or in the puerperal state. It is also said to be relatively frequent in subjects of a tender age. Kaposi)Path. u Therap. der Hautkrankt, Wien, 1882) has recognised it in all its manifestations at every age. It appears in the form of puncta striae, or diffuse and uniform blushes covering extensive areas of the integument, livid red, purplish, or brownish-red in hue, paling under pressure, but never leaving upon the skin over which the finger-nail is quickly drawn the characteristic whitish streak by which many physicians test a scarlatinal rash. The surfaces involved may be either not rasied or slightly elevated above the general level of the skin, and are usually circumscribed. The regions involved have been carefully described by Simon (Des Prodromal exanthem der Pcken, Arch. f. Dermat. und Syphalographie, 11, Jahrgang, S. 347 et seq.) and are sometimes spoken of as Simon's triangles. Thus the groin, the inner aspect of the thighs, and the hypogastric region may be involved at once (femoral triangle of Simon); the surface of the axilla, the pectoral region, and the inner face of the arm (brachial triangle of Simon), as also the extensor surfaces of the knees and the elbows, the dorsum of the feet, and indeed every portion of the body. In the midst of these rash-covered areas may also appear petechial or haemorrhagic, dark-red, pin-head to bean-sized maculae, which undergo colour-changes both in lighter and deeper shades as the invasion perios lapses. In lieu of these, however, transient wheals may come and go over the surface, and even the erythema described above may assume an erratic phase and appear in one part only to disappear and recur at another. None of these flash-light warnings of the oncoming exanthem are proportionate to the latter in the matter of extent and intensity of development. They may be followed by grave or mild manifestations of the disease. The subsequent eruption may also be much more abundantly developed in regions where the invasion rashes have not appeared, and the latter completely fade before the field thus deserted has been occupied by the former.

Finally, it must be borne in mind that the symptoms of the initial stage may be greatly modified in cetain cases. Many of the phenomena described may be entirely absent, while others may appear with special severity. The intensity of the fever may exhibit the greatest variation, from the slightest grade up to a severity such as is attained in few diseases. The initial stage is thus presented under the most varying phases. It should also be noted

that the subsequent course of the disease cannot always be foretold from the initial symptoms.

The duration of the initial stage is usually three days. Rarely it extends into the fourth, fifth, and even the sixth, day, after the premonetory chill and pyrexia.

S T A G E O F E R U P T I O N.
(Stadium Eruptionis).

Upon the subsidence of the stage of invasion the exanthem of the disease as a rule promptly appears. Simultaneously, the temperatire abates, the rapidity of the pulse diminishes, and there is a marked amelioration of the general symptoms. The patient, frequently deceived by the completeness of this defervescence, is apt to conclude that he is convalescent from his disorder, and is thus often astonished at the discovery of the exanthem upon the person, usually the face. In other cases, more commonly those of a grave character, there is failure of this defervescence, the febrile symptoms continuing or even increasing in severity. The eruption first appears in the in the form of pin-head sized and larger, firm, conical, discrete, coherent, or confluent, reddish papules, sometimes accompanied by mild sensations of a pricking or painful character, often exciting no subje ctive symptoms by which their presence could be declared. To the touch they are characteristically indurated, and suggest the hadrness of small shot imbedded in the skin. They appear first in greatest abundance upon the face and scalp, involving later and progressively the trunk, the extremities, and the palmer and plantar surfaces. It is at this moment that the eruption most resembles that to be recognised in measles. At times a reddish areola surrounds each lesion, especially those appearing upon the trunk. All are situated about the orifices of the follicles and glands of the skin. On the first and second days of the eruption the papular lesions multiply in number, involving an increasingly large area, and individually augmented in size; so they appear first upon the head, and are successively presented to the eye upon the lower portions of the body. The older lesions are usually recognised upon the scalp, face, neck, and shoulders; the more recent upon the extremities. By the third day of the eruptive stage there is usually evident at the apex of the older lesions a minute vesicle containing a drop of pellucid serum, which rapidly changes in character and size till a distinct vesicle is formed with cloudy or lactescent contents. Early in their career an apical depression can be seen, which later deepens into a characteristic umbilication.

This umbilication in the vesicular stage is somewhat peculiar. It is more than a mere depression of the summit, such as might be made by thrusting a blunt-pointed pin centrally and downward so as to carry the roof-wall before it. It is made clinically most distinct by the fluting or puckering of the peripheral part of the roof-wall, giving the lesion a cremated appearance, which is not assumed by any other cutaneous efflorescence of multiple development. It is looked upon as characteristic of the smallpox lesion. It is, however, not always present, and when seen it usually disappears with the full development of the pustules. If the vesicle be punctured, a small amount of a slightly mucilaginous serum exudes, by no means its entire conte nts. This leads to the conclusion that the interior is not uninterrupted, and that the fluid is not entirely free the reason for this has already been explained. During the fourth and fifth days of the eruption - when umbilication is usually well marked - the vesicles continue to increase in size, and the glazed top gradually assumes an opaque, whitish appearance. The eruption is not limited to the skin, but sometimes appears silumtaneously on the contignous mucous membranes at the various orifices of the body. The buccal cavity, nares, and throat seldom fail to show an eruption so that breathing and swallowing may be seriously interfered with, and great pain experienced.

STAGE OF SUPPURATION.

By the sixth day of the eruption the pock is usually mature. It is pea-sized and globular in shape; its umbilication has usually been quite removed by the complete filling of its chamber with distinctly purulent contents; it is often surrounded by a halo due to hyperaemia, or exudation; and, the total number of individual lesions being then fairly determined, it is often closely set against its fellows, islets of unaffected integument having meantime become fewer and more contracted. The face covered with this eruption, then exhibits a typical aspect. The entire integument becomes swollen and brawny, or oedematous. The eyes are thus closed by the tumid lids, which are separable with difficulty, and this, too, even though they may be the seat of comparatively few lesions. The nose, lips, cheeks, and ears are by similar processes deformed and given a most repulsive unsightliness. Mucous and puriform secretions gather and dry about the mucous outlets. The skin of other parts of the body - hands, feet, genitalia, and the entire extremities - is in a similar condition, merely most noticeable in the exposed and

disfigured face. The fever of maturation, or suppuration, or, as it is called sometimes, the secondary fever, is lighted to activity with the onset of the suppurative process. The temperature rises to a point raging between 101°F., and 105°F., the pulse-rate simultaneously rising to 100 and even 150 in the minute, varying, of course with the age of the patient and the severity of the attack. During its continuance, from the eight or ninth to the eleventh or twelfth day of the disease, the patient is in a critical condition. The intense grade of cutaneous inflammation, with its resulting subjective sensations of burning pain and tension, the soreness of the tongue, pharynx, inside of the lips, and palate, due to the existence of pus-filled pocks upon the buccal membrane, are all sufficient to account for the deplorable condition in which the patient lies. In mild intensity, the patient lies conscious, but in a stolid apathy, listlessly accepting the ministrations of his attendants. In others there is delirium of low or high grade, often sufficient to demand constant surveillance, lest in consequence the patient may do serious injury to himself. The behavious of the pustules which appear upon the mucous surfaces asscesible to the eye is modified somewhat by the heat, moisture, and friction to which these surfaces are exposed. Typical, fully-distended pustules occasionally persist upon the soft palate and inside of the lips. Soon, however, the macerated roof-wall yields, leaving a reddish floor where the mucous membrane is exposed, denuded of its epithelial layer, or covered with a new tender and hyperaemic pellicle. In grave and severe cases these pustular lesions may extend deeplu into the mucous tracts, involving the trachea, bronchi, or alimentary canal, even as far as the anus. The urethrea, vagina, vulva, external anditory canal - but never the tympanum (Kaposi) - are, in severe cases, similarly involved.

S T A G E O F D E S I C C A T I O N (Stadium Exsiccationis, sen Decrastationis).

This stage marks the decline of the attack. It begins usually on the thirteenth or fourteenth day of the disease, and, according to the severity of the previous pathological processes, requires for its completion from one week to a fortnight. Its onset is characterised by a second marked bu t gradually developed defervesence. With a diurnal temperature successively less elevated above the normal standard there is a corresponding fall of the

pulse-rate. As the disease has by this date taxed the vital resources of the system to the utmost limit, the exhaustion resulting may be evidenced by a pulse which is flagging , weak, and even below the standard of health as regards frequency. The cutaneous lesions now undergo a change. Some of the pustules rupture, and their viscid contents oozing forth, concrete into a yellowish crust , which gradually assumes a brownish hue. Others desiccate en masse, the roof-wall first collapsing upon the contents thus producing an appearance which again suggests umbilication of the lesions. This is sometimes termed a secondary umbilication. The desiccation en masse is doubtless due to the evaporation of a portion of the fluid exuded into the superficial strate of the integument, and the consequent inspissation of the pus. Often the face at this moment is totally concealed by a dense, dry, brownish or even blackish mask, composed of the crusts furnished by numerous individual lesions. At the same time the tumefaction of the skin subsides, and the subjective sensations towhich it gave rise gradually disappear. Beneath the crusts cicatrisation advances till the former are lessened, and finally, becoming detached, fall in quantity from the surfaces subjected to friction. Beneath them are seen brownish and violaceous blotches, the integument thus stained slowly losing its abnormal colour. It is thus seen to be the seat of multiple, slightly depressed, skining scars of a dead white colour, which in course of time lose somewhat of their disfiguring prominence, but which when typically distinct last for a lifetime. This exfoliation of crusts continues till the skin is completely rid of its pathological products, the process being completed with entire restoration to health about the end of the fourth or fifth week of the disease. Meantime, in favourable cases, convalescence progresses satisfactorily. The patient has a returning appetite, decadence of symptoms originating in impairment of function of the mucous membranes, and ordinary health is regained in due course.

(B) C O N F L U E N T F O R M (Variola Confluens).

The severity of the symptoms , the extent of eruption, and the fatal character of the disease, chiefly distinguish this variety of smallpox from the above-described

INCUBATION STAGE.

This period is relatively short, and presents no other peculiarity.

INITIAL STAGE.

The invasion of confluent variola is very severe. The premonitory chill is violent; the headache and lumbar pains are excruciating; the fever, rising, to a high grade, 106° to 110°F, with few and slight remissions, scarcely subsides, if at all, with the appearance of the eruption, the latter developing early, and exploding with violence over large areas of the surface of the body. The initial lesions of the exanthem are dense and deeply-set papules, so closely coherent even at this moment that they scarcely leave between them interspaces of sound skin. The latter is swollen, and a deep erythematous colour often gives the appearance of severe erysipelas. The skin is more widely oedanatous than in the latter disease, and on the affected surface numerous small vesicles may soon be detected, giving the appearance of a burn. The scalp is swollen and thickly set with pocks, which, on account of their unyielding base, are extremely painful.

The mucous membranes are almost always attacked with severity in confluent variola; so that the condition of the patient, which was in other respects deplorable, becomes thereby aggravated to an unbearable degree; indeed, in some cases, this complication is the immediate cause of a fatal termination. Upon the mucous membrane of the mouth and throat the eruption is usually confluent. The lesions may spread over the soft pallate, the tonsils, the posterior wall of the pharynx, and thence into the nasal cavities, leading to the early occlusion of the latter from swelling of its mucous membrane. The larynx is attacked with marked severity in almost every case, the affection often eventuating in the formation of submucous adscesses, necrosis of the cartilages, and acute oedema of the glottis. While in other forms of smallpox the conjunctive either remains entirely free from exanthem, or is affected in but a moderate degree, in this variety it is beset with points of efforescence in great numbers, which unfortunately sometimes lead to purulent keratitis with perforation. The affection in the mouth is often accompanied by inflammation of the parotis glands, by extension of the inflammatory process along Steno's duct. A very troublesome symptom is severe salivation, which the violent pharyngitis, by rendering deglutition impossible, greatly aggravates.

SUPPURATION.

During the vesico - pustular transformation which the lesions undergo on the se cond day there is more or less complete coalescence of the elements of the eruption, which circumstance has given this form of the disease its name confluent variola. This confluence is most conspicuous on the face and hands, whre large flat vesicles run together, form pus-filled bullae and finally convert the surface on which they rest into a single, large, many-chambered pustule. All this occurs upon an enormously swollen and inflamed skin, disfiguring every feature of the face and well nigh obliterating every external distinction between the scalp, nose, eyes, and mouth. Here and there the mass is elevated by the quantity of exuded pus to a more notable projection from the surface. Pustules filled with blood may appear at several points. At others , the suppurative inflammation may be seen to have eroded the skin, which is covered with a membranous exudation similar to that covering the mucous membranes lining the mouth, nose, and ears. The skin in its totality often yields to these destructive processes and becomes gangrenous over large areas. The confluence of the lesions is less marked in other parts of the body than the face and hands, yet the entire surface may be covered with a coherent exanthem which becomes elsewhere, in large areas confluent. In many casesthe head of a pin cannot be placed upon an unaffected patch of skin in any portion of the body. This coalescence of the pustular lesions is particularly apt to occur on the parts subjected to pressure in the reclining posture, such as the back, shoulders, and buttocks.

The lesions attain their maturity on the eight day, when serious adynamic symptoms often supervene. There is not infrequently a marked rise of temperature, which is called "secondary fever" This is unquestionably septicalmic in character, and is usually in proportion to the extent of the eruption. It attains a height of 104° to 106° , and even 107°F. has been observed. It is more constant than in the milder forms, and is usually proceeded by a chill and accompanied by great prostration. The breathing, which at the beginning of the eruptive stage became easier, is again short and laboured, the pulse is small, frequent, and often fluttering; and the mental condition of the patient is betrayed by a delirium of varying grade or a state of coma. In this condition a fatal result is often induced by either exhaustion of the vital forces or an intercurrent malady, such as pleurisy, pneumonia, cardiac inflammation, oedema of the glottis, or an uncontrollable diarrhoea. In yet other cases the patient falls into a typhoid state, and, after surviving for a fortnight or more with low fever, a broncho-pneumonia, or a diarrhoea, succumbs to an inevitable exhaustion, the

surface of the body being yet covered with a dry crust that is black and foetid. Before the patient expires, there is usually a rapid rise of temperature which, according to Simon)Charité Annalen, xii, Bd. 5.), continues to rise to 110° 75°or 112°20F., for an hour or two, after death. If the patient survive, within a day or two, the oedema begins to subside, and the redness of the skin disappears, excepting an erythematous ring, or halo (more pronounced and of deeper colour than in varicella, and best seen on the extremities and trunk) which surrounds yhe pustules.

STAGE OF DESICCATION. At this period of the attack large coherent scabs are formed in the confluent patches, which for a long time remain firmly adherent to the skin, while beneath them suppuration of the paillary layer, which is always markedly implicated, generally continues for a time. The eruption usually shows these signs of subsidence after the eleventh day. The nauseating odour of the pustules is by some regarded as characteristic of the disease. Large blackish crusts are formed as the desiccation proceeds. These give rise to an appearance as if a rough blackish envelope surrounded the hands and feet, whose movements, indeed, they considerably restrict. As the swelling subsides intense itching sets in, and still further contributes to the patient's sufferings. Pyaemia may carry off the patient at this period, or fatality may result from pneumonia, pleurisy, dysentry, or other complication; often, too, from extreme exhaustion. The temperature gradually falls to normal in favorable cases, or becomes irregular if death be approaching. With the former change the appetite returns and the eyes are again visible. On inspection the pustules may be seen to have existed on the conjunctiva; in rare cases total blindness remains from corneal implication. Usually the eyes escape from being injured. The tongue clears, and from the fifteenth to the eighteenth day the crusts drop off, leaving reddish or purplish spots, which vary in colour according to the condition of the surrounding atmosphere, changing from blue to red. Soon this is replaced by a dark-brownish pigmentation. After the scabs have fallen off, deep losses of substance are left behind in the curtis, giving rise to extremely ugly scars which, in the face especially, often produce permanent and very unsightly disfigurments. Permanent baldness is not an infrequent result of confluent smallpox, the hair falling out in tufts,

either with the hardened concretions or upon the slightest traction. Should, however, the destructive inflammation not have been deep and the papillae escape, the hair grows again, but usually altered in texture. Thus it may grow in an irregular fashion, or be thick and curly. The beard may suffer in a similar manner, but the nails seldom are involved to such an extent as to lead to their irreparable loss. Recovery is always slow and convalescence may be interrupted or death occur by secondary infection with pyogenic organisms.

THE SEMICONFLUENT OR COHERENT FORM.

The term variola semiconfluent, or coherent smallpox, is applied to those cases in which (1) the pustules touch one another without coalescing, or (2) when the eruption is confluent on and about the face, but more or less discrete in other places. It is a connecting link between the two extremes of variola vera. The face is most severely affected, the hands and forearms next . Most cases recover in four weeks, the affection being one of moderate grade.

T H E C O R Y M B O S E F O R M.

The name variola corymbosa was first applied by Marson to a rare form of smallpox, in which the pustules are confluent in patches or clusters, these being separated from each other by intervals of unaffected skin. An eruption of this nature may be found on vascular parts like the arm-pits, groins, and poplittal spaces. Sauvages (Nosologica Methodica, Lipsae, 1791, p. 265) cites Helvetins as having used the name of cudicate a species of malignant aggregation of pustules most commonly met with on the face. Marson states that this is a very fatal variety of the disease, the mortality being about 40 per cent. According to Hilton Fagge, it was in the London Smallpox Hospital as fatal almost to the vaccinated as to those who were unprotected. Convalescence is always tedious, and the risk of fatality from some complication is at all times very great.

V A R I O L A H A E M O R R H A G I C A.

(Haemorrhagic Smallpox; black smallpox; variola nigra; variola maligna, etc.).

Black smallpox used formerly to be

much more common than at present. The protective influence of vaccination and improved sanitary conditions have made it a somewhat rare variety of variola.

THE PURPURIC FORM. (Variola purpurica, purpuric variolosa, Schwarzen tod. etc.).

In this variety of smallpox the incubation period is brief and distinguished by unusual conditions of malaise and lumbar pain. On the fourth day there is intense fever with rapid pulse, and this is speedily followed by a deep purplish-red staining of the face, neck, trunk, and extremities, the skin thus affected being slightly tumid and quite dry. Minute macule-papules can be distinguished here and there over the surface, often set closely together, and presenting the characteristic colour described above. At this stage of the disease the eruption greatly suggests an intense rubeolous exanthem, and has been, as a result, repeatedly mistaken for the so-called black measles. But the excriciating pains persist, there is often coincident delirium, and the pin-head sized macule-papules noted above become lenticular in shape, cease to lose their colour under the pressure of the finger, extend peripherablly even in a few hours, flatten and become purpuric patches of a bluish-black shade, palm-sized and even larger, covering extensive areas of the integument, new lesions forming in unaffected islets of the skin, conjunctival ecchymoses appear at the angles formed by the lids, and finally encircle the cornea with an annular purplish-black cushion. The mucous surfaces become dry, crack, and bleed where the epithelium is torn, and become covered with offensive crusts. The odour exhaled by the patient is intolerably foetid. He lies stupid as progress to a fatal issue is hourly hastened. Haemorrhages occur from the larynx, bronchial membrane, intestinal surfaces, and even into the parenchyma of the viscera, the muscles, serous membranes, periosteum, and neurilemma. The urine is retained in the bladder, the respirations rapidly increase in frequency, the pulse flutters; and death closes the scene between one and two days from the commencement of the disease. Unlike fatal cases of confluent smallpox, the mind remains remarkably clear until within a few hours before death; which latter is, according to Zuelzer (Beit. zur. Pathol. and Therap der Variola, Berl. klin. Woch., 1872, No.51), is sometime preceded by a general hyperaesthesia, or amaesthesia of the skin, with paralysis of the extremities

THE HAEMORRHAGIC FORM (Variola Haemorrhagica Pustulosa.)

In this somewhat rare form of haemorrhagic smallpox there are the usual unfavorable portents of intense prodromal symptoms. On the fourth day the skin is swollen and indurated in consequence of the development within its structures of numerous firm, roundish, slightly acuminate papules, so thickly set together that it is wellnigh impossible to distinguish between them. These are early in betraying the bluish -black hue significant of haemorrhage into their mass. They multiply in number and increase in size, while their haemorrhagic stains widen and sweep from each other as a centre, like the waves that spread from a pebble thrown into still water. In these cases, more often than in those first described, pus-filled pocks may develop over some portions of the surface, while in others a species of gangrene occurs in consequence of the separations of the derma from the subcutaneous tissues by effused blood. At times pustules of somewhat typical aspect are formed and subsequently filled with blood by a haemorrhage from below. The characteristic appearances of this variety of smallpox are first seen upon the lower extremities . It seems to correspond to the "anomalous" or "irregular" smallpox of 1670, so described by Sydenham, who also speaks of the malady as "this dangerous black smallpox" (Variolae nigrae), in which "the eruptions were more inflamed, and in the declension after their suppuration frequently looked black." It is also termed Variolae crutentae or bloody smallpox. Recovery is extremely rare. It most frequently occurs in elderly persons past the prime of life, in the debilitated, in pregnant women, and in convalescents.

SECONDARY HAEMORRHAGIC, OR EXUDATIVE, FORM (Variola cum Haemorrhagia Secundaria).

This is a form of smallpox quite distinct from the two varieties described above. It occurs in delirious patients, who leave their beds and run about, where pustules of the lower extremities become filled with blood in a purely mechanical manner, as happens in ulcers of the legs under similar circumstances. That this occurrence is no dangerous symptom the subsequent normal course of the disease clearly proves.

V A R I O L A M O D I F I C A T A.

(Modified and Anomalous Smallpox; Varioloid).

Varioloid is that form of smallpox in which the disease is modified, either in its course, duration, or intensity of symptoms, such modofication usually resulting, directly or indirectly , from a previous attack of variola or from the protective influence of vaccination. Varioloid was formerly considered by some to be a distinct affection resembling variola, which, according to Rayer(Traité Maladies de le Peau, Parisis, 1835, tome i. p. 577), the term was first used by Thomson of Edinburgh, in 1820, to include variocella and all mild affections which he supposed to be modifications of the variola poison.

Patients regarded as suffering from varioloid have all the symptoms of variola, modified, however, in the direction of a mitigation of their intensity and dangerous character. It is thus evident that there is no strict line of demarcation between the very mildest physical expression of the variolous poison and that variola vera which presents atypically benign symptoms in any stage of its career. Within this wide range of possibilities cases of varioloid, which differ from each other by very marked degrees, occur .

As compared with variola vera there may be a shortening or lengthening of the invasion stage of varioloid, i.e., it may be insignificant or intensity marked as regards the severity of its symptoms. According to Bartholow (loc. cit.), the invasion rashes are here of common occurrence, and the more extensive the latter, the less copious the subsequent eruption. It must be admitted that this view has not been confirmed by the experience of others.

There may follow after the high fever and severe cophalic and lumbar pains of this stage, in the case of varioloid, a complete defervescence and the appearance of a very copious exanthem. With this, however, the climax of the disease may be reached, and the subsequent symptoms be altogether insignificant in comparison with those that have proceeded. Thus the maculo-papules may never reach a vesicular stage, or, having attained this, the vesicles may not be umbilicated, or may shrivel after their contents have assumed a lactescent colour, and be succeeded by light superficial crusts which in a few days fall. Or, again, the

pustular stages of the lesion may be fully developed even with the production of a halo about the pocks, while there is yet no swelling of the skin and but trifling subjective sensations experienced by the patient. The pustules in the course of from four days to a week desiccate and are shed, leaving behind them violaceous pigmentations of the surface without perisitent cicatrices. Other cases, again, instead of producing the impression upon an observer of being illustrations of a malady aborted or cut short at some period of its career, seem to exhibit merely a modification in the intensity or distribution of symptoms betrayed in a wellnigh typical career. Thus, there may be a total absence or insignificant reminder of the septic fever usually known as the secondary fever of variola, and the elements of the eruption may be few or appear in scanty number upon the face and more copiously elsewhere. The latter may, however, pursue a perfectly typical course and characteristic scars follow.

In another common type of varioloid the patient exhibits distinct symptoms of malaise in the period of incubation. The fever of invasion, with its characteristic pains and nausea, is equally well marked. Defer vescence occurs with a trifling eruption of muculo-papules, which in a few days have wellnigh disappeared. There is no secondary fever, but the patient feels fra from well. There is a period of anaemis, mental depression, mental langour, and unmistakable evidences of physical prostration out of all proportion to the precedent symptoms. In these cases it may well be believed that the poison has produced a strong impression upon the nervous centres. A tedious convalescence from an apparently trifling form of the malady is the most characteristic feature of these cases.

In consequence of the individual pecularities or of the special surroundings of the patient, a variation as to the form and contents of the lesion of modified variola occasionally occurs. A number of useless terms have beenemployed to designate these peculiarities, the most of which are relics of the superstitions of the past. In variola siliquosa the pocks are said to contain air only; in variola pemphicosa, bullous lesions predominate; in variola verrucosa, the papules, after partial evolution and involution, leave minute-wart-like papillary masses upon the face; in variola crystallina there are superficial vesicles only filled with clear serum, which somewhat resemble those recognised as sudamina. The older writers with a

little reason described cases of hornpox, swinepox, etc., differing only from those of variola by the anomalous behaviour of the exanthem in the course of its evolution. Besides the terms given above, Hebra gives the following list of Latin adjectives which have been employed to describe special varieties of smallpox, none of which require special explanation; variola papulosa, cnicaa, acuminata, globosa, globulosa, tuberculosa, carbunculosa, cornea, rosea, fimbriata, miliaries, lymphatica, vesiculosa, pustularis, morbillosa.

Sydenham, Peter Frank, and others describe a Febris variolosa sine exanthemate, -- which Haen called Variolae sine variolis, -- in which the disease terminates with the initial stage and the patient receovers within from three to five or six days, no rash being detected weamwhile.

The identity of varioloid with variola is abundantly shewn - first, byt the occurrence of intermediate forms of every grade, from the mildest evidence of variolous poisoning to typically developed cases of variola vera, second, by the fact that the patients affected with varioloid are capable of transmitting variola to the unprotected; third , by the anatomico -- pathological fact that the structure of the pock, when it appears, is the same in all varieties.

C O M P L I C A T I O N S A N D S E Q R E L A E

The complications and sequelae of variola are fewer in number and more restricted in range than those of many other maladies. This results from the remarkable unity of the disease as it occurs in its several manifestations among the unprotected, its relatively rapid course, and its absolute disappearance on the completion of its attack. There is no chronic form of smallpox lingering for weeks or months after the violence of the fever has abated. As there is no well-marked dividing line between the complications of variola and the local affections belonging to the disease it will sometimes perhaps be necessary frequently to repeat previous remarks appertaining to the latter.

T H E S K I N

As the brunt of the attack falls upon the integument this suffers severely, and may be the seat of the multiple abscesses, varying in size from a pea to a child's head. They appear in and after the stage of desiccation, and are apt to indefinitely prolong convalesvence. They may be found in all parts of the body, but especially upon the arms and legs, the buttocks, shoulders, and scalp. Ischiorectal abscess is a common complication or sequel, and is ushered in by sudden rigors and increased pyrexia. If properly treated it is not painful and produces no serious constitutional disturbances or inconvenience (Trousseau). In the stages of desiccation and desgnamation erysipelas is a somewhat frequent and serious complication. It attacks the face and scalp, occasionally the scrotum. The accompanying pyrexia is apt to run high, and may so exhaust the patient as to lead to a fatal issue. The danger may be still further increased by the depth to which the erysipetatous inflammation is apt to penetrate, constituting phlegmonous erysipelas and perhaps giving rise to diffuse cellulitis. In the later stages, boils are frequent and most troublesome. They are due to secondary infection with the staphylococcus pyogenes aureus and other pyogenic organisma. Trousseau regards them as manifestations of a "faremcular diathesis". When properly and hygienically nursed, bedsores seldom complicate a variol

ous

illness. Gangrene has been known to attack the scrotum; at most it is a very rare complication. Acne pustulosa has sometimes been seen to develop on the face, particularly over the bridge and along the sides of the nose.

Pigmentation - brownish discolouration - of the skin, due to acute dermatitis, often persists for a long time after smallpox. Much prognostic importance has been attached by Trousseau to the extreme swelling of the hands and feet which, commonly follows salivation and swelling of the face in variola. He and others regard the chance of recovery as almost nil if this swelling fails to appear. This swelling of the limbs sets in at the close of the ninth day with severe pain, which becomesvery violent on the eleventh or twelfth day and lasts until the thirteenth or fourteenth day, when swelling and pain subside together. Like the swelling of the face, this oedema of the hands and feet depends on the maturation of the pustules. The extreme tension, which results from the formation of pustules under the dense fascia of the palms of the hands and the soles of the feet, is directly responsible for the great pain experienced by the patient.

T H E E Y E S.

The complication of the eyes of the smallpox patient has been referred to above. The possibility of the disorder terminating, after an otherwise favourable convalescence, in total blindness, should not be forgotten. The cornea may be the seat of pustules or diffuse puriform infiltration resulting i n ulceration, and eventually perforation with hernia of the iris. At times it is merely macerated by the pus continually covering it, and in that condition yields to even moderate pressure. At others the deeper portions of the globe fall into inflammation, and there is a resulting cyclitis, irido - cyclitis - or parophthalmia. It is noteworthy that Hebra saw only one per cent. of ocular complications among five thousand cases of variola.

T H E E A R S.

The disease may involve the external ear, the tympanium may disappear, a severe otitis supervene, and the mastoid cells become filled with pus and detritus of necosed tissue, and complete deafness. The last-named Stokes states can occur also from paresis of the auditory nerve, leading to an acute degenerative softening

of the intrinsic muscles of the ear.

THE NERVOUS SYSTEM.

The variolous poison affects the nervous system from the first, and chiefly as regards the production of violent delirium in severe cases. This may be followed by fatal coma, and in children convulsions may be seen. Very rarely paraplegia has been observed during the attack, though it is more common during the convalescence, and is then due to different causes, such as peripheral neuritis and disseminated myclitis. Multiple neuritis may be a sequel or the pharyngeal nerve may be affected. Among other conditions rarely arising during convalescence are insanity, epilepsy, and hemiplegis. Meningitis seldom complicates the attack. A red streak -- the "tache cérébrale"- is often left upon the skin after pressure with the finger. Mackenzie mentions acute anterior poliomyelitis as having occurred after smallpox. According to Hughlings Jackson, Many of these nervous disturbances are due to thrombosis of the capollaries of the medulla. Westphal (Heber Nerven affectionen nach Pocken, Berl. klin. Woch., 1872, No. 1.) has seen marked paralysis of the bladder after variola.

THE JOINTS.

These are seldom affected. Painful swellings, effusions of serum and pus, inflammation of the cartilages of the bone itself have been described as most commonly occurring in strumous subjects.

THE NOSE

Severe destructive defects may follow the pustular involvement of the Schneiderian membrane, including necrosis of the nasal bones and severe epistoxis.

RESPIRATORY ORGANS.

As already indicated, the larynx may be lined with pustules, and complications may arise in the shape of oedema of the ary-epiglottic folds (White ; Surgical Aspects of Small-pox, Med. News, Mar. 4. 1882, p 24), laryngo - oesophageal abscess and various dipththeritic deposits lining every portion of the mucous membrane. Bronchitis accompanies almost all cases of variola, and is, therefore, more of a symptom than a complication. In some cases, however, it leads to catarrhal pneumonia and pulmonary tuberculosis. Croupons pneumonia is by no means infrequent, but oedema of the lungs is rarely

encountered. Pleurisy with purulent effusion from the outset, may arise from extension of inflammation from the lungs to the pleura, or from a secondary infection by pyrgenic micro-organisms.

C I R C U L A T O R Y O R G A N S.

Pericarditis is a rare secondary affection, and endocarditis rarer still. Myocarditis has been seen by Mac Combie in a large number of confluent cases. The occurrence of haemorrhages has been noted elsewhere. Venous thrombosis may sometimes be seen, causing phlegmasia dolens ("white leg"). The latter may also be due to diffuse cellulitis.

D I G E S T I V E O R G A N S.

The tongue may become so swollen as to actually protrude from the mouth and interfere with deglutition and respiration. The lesion is a true glossitis, and it may be associated with ulcerative stomatitis. Inflammation of the salivary glands is less often seen now than in former times: it is no longer regarded as seriously as then. When the intestines are the seat of a variolous eruption there may be persistent diarrhoea, which is frequently fatal, especially in unvaccinated children. A "variola dysenterica" has been described by Sydenham. Haemorrhagic smallpox may be accompanied by meloena or haematemesis. Peritonitis is usually due to a local cause, such as abortion or splenic infarction (Mac Combie).

U R I N A R Y O R G A N S.

The severe forms of smallpox may have albuminuria. This is not necessarily due to kidney disease, as blood serum may find its way into the urine in consequence of the excessive blood changes which occur in grave cases. Haemaruria is a common symptom in purpuric variola. Acute nephritis usually occurs during convalescence, seldom during the acute illness. Cystitis is apt to follow retention of urine.

G E N E R A L O R G A N S.

Trousseau has seen orchitis and ovaritis develop at the same time as the exanthem, and a detailed account of these conditions has been published by Béraud (Arch. gén. de Méd., 1859, Nos. 3 and 5.)

P Y A E M I A A N D S E P T I C A E M I A.

Among the rare complications sequels of the

variolous seizure are pyaemia and septicaemia. The symptoms of these conditions present no unusual features.

D I A G N O S I S.

One of the most important and critical of the duties of every practitioner is the establishment of a correct diagnosis when there is a question of variola. Upon such decisions have turned, again and again, professional success or disaster. To pronounce a case to be variolous, which is not of such a nature, is to subject a medical man to the indignation of the few and the ridicule of the many. On the other hand to be guilty of treating a patient with smallpox, and of remaining ignorant of the nature of the malady, is to subject many innocent persons to the danger of exposure to the disease and to render one's self liable for the redress sought by recourse to the civil authorities and the law. Which predicament is the graver it is difficult to say.

In variola with well-marked pustular eruption the diagnosis is a matter of simplicity; but, in the less severe cases, especially in the varioloid, when the eruption is scanty and undeveloped, the recognition of the malady becomes more difficult. The disease may then be confounded with various cutaneous affections.

Sometimes impossible, at least much more difficult, may it be to arrive at a correct diagnosis during the invasion stage of smallpox. High fever with severe lumbar pain, considerable gastric distress, and the appearance of one of the invasion rashes described would, however, put the observant practitioner on his guard. When the variolous exanthem first appears the practitioner should secure as soon as practicable a history of the invasion stage if this has not been subject to his personal observation. He should then make careful enquiry as to the possibility of a neighbouring source of contagion, and ascertain by inspection whether the person of the patient exhibits the evidences of successful vaccination. In this connection it is always well to estimate the value of the elements represented by (a) the period ascertained as having elapsed since the last successful vaccination ; (b) the typical or atypical character of the existing cicatrices of vaccination; (c) the unicity or simplicity of the cicatrices simultaneously resulting from vaccination performed at one and the same date. Fortunately, if an epidemic is present, smallpox is nearly always easily recognised; but in sporadic cases, or during the period prior to the appearance of the exanthem , it may require differentiation from the following

diseases;--

D I F F E R E N T I A L D I A G N O S I S.

M E A S L E S.

Measles is far more frequently mistaken for smallpox than any other disease is mistaken for it. In smallpox the eruption usually appears upon the third day, or after forty-eight hours' illness. In measles the eruption generally appears on the fourth day, or after seventy-two hours illness; there is; besides, usually some cough, and lachrymal discharge and fiery redness of the eyes. The eruption, too, of measles, although a little elevated above the surface of the skin, is not so distinctly felt as in smallpox; it appears to be more superficial. The lapse of forty-eight hours after the commencement of the illness before the appearance of the eruption, the pain in the back, and the shotty feel of the eruption in smallpox, contrasted with the lapse of seventy-two hours of illness before eruption in measles, the cough, redness of the eyes, and less marked feeling of hardness and prominence on the skin, should be enough, compared with the general appearance of the patient, to distinguish the two diseases; especially if koplike spots are found upon the buccal mucous membrane. These are regarded by many as almost pathognomic of measles.

S C A R L E T F E V E R.

In scarlatina the uniform diffuseness of the exanthematous blush, the absence of papules and vesico-papules, the continuance of the fever after the rash has appeared, the characteristic scarlet or boiled-lobster colour of the skin, and the anginose condition of the throat, are all significant conditions. The prodromal rash of smallpox which counterfeits scarlet fever is met with for the most part in mild cases, and is seldom accompanied with important anginal symptoms. Finally the age of the patient is of great assistance; adults seldom suffer from scarlatine, and the prodromal rashes of smallpox do not often occur in children.

I M P E T I G O.

To distinguish betwee n smallpox and the pustular eruption known as impetigo is sometimes not easy. There is, however, no initial stage in impetigo; it begins as vesico-pustules, not papules, which appear on the normal skin and are superficial and enlarge by peripheral extension,

after attaining the size of a sixpense and having a flat appearance. The patient may infect new areas by scratching. The malady leaves no scars.

S Y P H I L I S. The pustules of variola may be confounded with pustular syphiloderum; but in the latter there should be a history of a chromic rather than of an acute affection, and, as a result, the simultaneous appearance of lesions in very different stages of their career, some distended with pus, others ruptured and crusted, yet others which have recently formed in the immediate vicinity of the oldest lesions, while the katter have been in full involution or have been replaced by losses of tissue that are superficial.

V A R I C E L L A. There can be no doubt that mistakes have occurred in determining between variola and varicella. Their distinction is of prime importance; and, in cases of doubt, in order to protect the community, it is advisable for the practitioner to act as if the disease were really varioloid. The following table displays features of both diseases upon which a differential diagnosis can be based;

Variola	Varicella
History.	
1 Nervous or existing case in the vicinity	1 Traceable to persons or present case of vericella
2 Not successfully vaccinated	2 Negative
3 Occurs at any age	3 More commonly in childhood.
4 Characteristic prodromata; rash on third day	4 Eruption not preceded by prodromata
5 Sacral pain, high fever and vomiting common	5 Quite uncommon.
Eruptions	
6 Appears first upon forehead, extending downward	6 Appears first over parts covered by clothing. No regular progression over the body.

7 Vesicles uniform in size umbilicated, and deeper seated	7 vary much in size, rarely umbilicated, and feel soft and velvety.
8 Eruption contains serum, later pus.	8 Only serum, giving pearly translucency.
9 Most abundant on face & fingers	9 Most abundant upon back and lower extremities.
10 Various stages of eruption observed at points removed from each other.	10 Various stages side by side.
11 Pin-prick does not cause collapse of vesicles, being multilocular.	11 Does cause collapse, being unilocular
12 Secondary fever usually present	12 Absent

I N F L U E N Z A.

The premonitory symptoms of variola may be mistaken for infleuenza. Later, however, the appearance of the characteristic exanthem makes the natures of the disease no longer a matter of doubt.

D R U G E R U P T I O N S.

During epidemic times persons may show eruptions which are in reality due to the ingestion of such drugs as cuhebs, copaiba, and iodide of potassium. An accurate history of the previous condition in these cases is of importance, as, too, the odour of the drug, and the absence of febrile symptoms.

ECZEMA, HERPES, ACNE, etc.

These and other skind affections are at times not easy to differentiate from variola, but the history of the case, and the subsequent behaviour of the malady will usually suffice for diagnostic purposes.

G L A N D E R S.

T his calls for special mention, as, according to Liveling , it is in an early stage one most likely to be mistaken for smallpox, which disease its febrile symptoms closely resemble, and the rash consists of hard infiltrations in the skin and mucous membranes, which quickly suppurate and form deep and inflamed ulcers. Before ulceration has begun, and when the infiltrations are small and scattered, the diagnosis may be difficult . The rash of glanders, however, comes out

in successive crops and ulcertate rapidly; and the disease itself is rare and usually occurs in grooms and stablemen.

M E N I N G I T I S.

This disease may closely resemble the initial stage of smallpox. In both there are intense headache, vertige, delirium, convulsions, and coma. The most doubtful cases are those of meningitis of the convexity extending over both hemispheres and without localising symptoms. The rash of smallpox is, however, wanting, and the fever runs on in meningitis. Basilar meningitis may be recognised by the local symptoms belonging to it. The difficulty of diagnosis is much increased in cases of epidemic cerebrospinal meningitis with erythematous and purpuric eruptions, but it can usually be distinguished by its etiology and close clinical observation .

A C U T E R H E U M A T I S M.

When accompanied by erythematous or purpuric rashes, or by abundant crops of sudamina or miliary vesicles, acute rheumatism may simulate variola by reason of the pains, fever, and the sweating. Soon, however, all difficulty will vanish, as the two diseases run an essentially different course.

T Y P H U S F E V E R.

Typhus and variola often resemble one another as regards onset. The course of the fever during this period is scarcely a guide. In both diseases there is the same rapid increase of temperature, and often the same maximum. But when the eruption appears the temperature falls in smallpox and does not in typhus. In the latter disease, moreover, the rash does not affect the face in particular, but does so in the former.

T Y P H O I D F E V E R.

This disease is seldom mistaken for variola, especially if the patient be closely observed and the peculiar ste p-ladder temperature curve be noted.

A C U T E M I L I A R Y T U B E R C U L O S I S

This affection may simulate the initial stage of variola, but the ophthalmoscopic appearances, and the absence of a positive history of exposure to variolous infection may help to a right conclu-

sion

without much delay.

P N E U M O N I A.

This may perhaps be suggested by by the initial frequency of respiration, the chill, and the pyrexia of variola, but the physical signs and future manifestations of the illness should remove all uncertainty.

E R Y S I P E L AS.

The great swelling of the face in confluent variola is very like erysipelas, but a careful physical examination would be sufficient to set the question of differentiation at rest.

P R O A N O S I S.

The foretelling of the result in a case of smallpox is wellnigh inseparably associated with the question of protection by vaccination . Variola vera in the unprotected is an exceedingly fatal malady, the death - rate varying in different epidemics according to the severity of each and the ages and hygienic surroundings of the victims of the disease from ten to fifty per cent. of unprotected persons affected with the disease occurring in epidemic form in any given community will perish. This number may, however, be enormously increased, as, for example, among a large number of unprotected individuals crowded together in filthy surroundings, or when the malady makes a periodical visitation to an insular community, where long isolation has begotten a carelessness with respect to vaccination. It is important to examine the vaccination marks upon the patient before prognosticating the outcome of this illness. If the operation has been performed in four or more places, and the corresponding cicatrices remain of good quality, readily seen, the case will, in all likelihood, end well. The early symptoms of smallpox may be severe, often are so, in well-vaccinated cases, but they subside as soon as the eruption develops, which is usually highly modified, and all goes well. But there are, unfortunately, many persons who have not had vaccination well performed, and they will suffer from smallpox, probably, accordingly. When one or two cicatrices can just be seen, or doubtfully seen, the case may be as severe as if there had been no vaccinatio n. at all, the eruption passes through its several stages quite unmodified, and the disease proceeds, and terminates, uninfluenced in any way by the previous vaccination.

The highest mortality from variola is seen in children between one and ten years of age who have never been vaccinated: in such it has been known to reach as high as 58 per cent. Besides the low vital resistance at this period, it must be remembered that the implication of the mouth, nose, and pharynx, in infants at the breast may cause death by interference with suckling. We learn that before Jenner's time one-tenth of all children born perished from smallpox; and that, of the mortality at all ages, between 7 and 12 per cent. was due to

disease. The mortality from the age of forty onwards is again high, the minimum death-rate being between the fiftieth and twentieth year of life. Mac Combie)Allbutt's System of Medicine) gives the following table, showing the number of cases, deaths and pecentage of mortality in different quinqenniads up to thirty;

	Cases	Deaths	Mortality per cent
		Unvaccinated	
Under 5 years	1131	647	57.2
5 to 9 years	952	358	40.4
10 to 14 years	607	155	25.5
15 to 19 years	385	158	41.0
20 to 24 years	276	128	46.3
25 to 29 years	199	91	47.7
30 and upward	390	194	50.0
	3940	1758	44.6
		Vaccinated	
	385	30	7.8
	1.468	59	4.0
	3.080	90	2.9
	4.091	191	4.6
	3.486	321	9.2
	2.079	228	10.9
	3.167	522	16.4
	17.756	1441	8. 1

Usually the prognosis is more unfavorable in women than in men owing to the conditions which favor haem orrhagic manifestations and the occureence of the complications of child-birth. Pregnancy is always a most unfortunate and dangerous complication in smallpox. Abortion is very apt to take place. In fatal cases the foetus is usually born before death. It is generally born dead, but not invariably so. Although the danger in smallpox is very much increased by pregnancy, and should always be taken seriously into account in forming a prognosis, pregnancy patients occasionally do well, especially after vaccination. They sometimes abort, and sometimes do not; sometimes both mother and child do well.

An intense series of prodromal symptoms, followed by the appearance of an unusually large number of cutaneous lesions, is often unfavourable. Confluence of the latter adds to the gravity; haemorrhagic and purpuric symptoms are in the highest degree portentious, and commonly indicate a

fatal result. Chronic alcholism and the cache xia induced by all chronic visceral and systematic disorders are sources of weakness , which largely increase the mortality by adding to the heavy strain upon the vital energies. The prognosis is rendered uncertain or unpromising by extensive involvement of the mucous as well as of the cutaneous surfaces, by marked visceral complications, by evidences of shock or exhaustion before the maturation of the eruption is reached, by grave sequelae, and by simple complications of the malady when, instead of entering, promptly upon convalescence, the patient lingers for weeks in a low condition. An unfavourable symptom in any case is the sudden cessation of the processes actively pursued upon the surface of the body. The swelling of the integument then suddenly diminishes and the crusts by which it was covered shrivel. The eruption, in brief seems to undergo what may be described as collapse. The pulse at such moments usually flutters feebly, and there are other portents of dissolution which can scarcely fail to be interpreted correctly. Varioloid is seldom fatal, and when death occurs it is the result of complications, as in the debilitated from disease or senility. Haemorrhagic variola is the most fatal form of all, and the confluent variety is a matter for great anxiety.

On the other hand the practitioner in the presence of this most loathsome and terrible disease should never despair, and even apparently desperate cases of smallpox are won back to life.

T R E A T M E N T

P R O P H Y L A X I S.

In dealing with smallpox two maxim indications arise; First, the prevention of its spread to others, and, second, the actual treatment of the disease itself. The loftiest end to be reached by the physician of our day with respect to this disease is its complete removal from all civilized countries, and indeed from the face of the earth by the practice of universal vaccination and revaccination. The evident modification which the disease has undergone in late years as a consequence of the extraordinary attention given to this subject is an earnest of the future. The day is probably not far distant when the man, woman, and child unprotected by vaccination will probably be regarded as an enemy of the human race, and treated accordingly. Evidences of the most satisfactory character as to successful vaccination should be imperatively required of all applicants for admission to schools, academies, colleges, charitable institutions, public libraries, art-galleries, and places of labour controlled by incorporated institutions; of all members of conventions, legislatures, political, religious, and deliberative bodies; of every purchaser of a ticket for the purposes of travel; and of every voter. In addition there should be in every district a systematic and periodical inspections of all persons registered in the census by persons qualified and competent to perform compulsory vaccination.

Whilst dealing with the question of vaccination a few words here will be devoted to a practice that preceded it, namely that of the intentional inoculation of smallpox ---- or simple inoculation, latterly called variolation. In very early times various Oriental peoples became aware of the fact that smallpox might be very decidedly mitigated by inoculation. This was practised in various ways, all of which may be reduced to the process of inserting smallpox virus into a solution of continuity. Lady Montague, the wife of an English Ambassador to Turkey, brought the practice back to England with her, where it soon made its way into popular favor, and whence it spread rapidly over Europe and America. Thus contracted, smallpox was shorn of a great part of its terrors; the eruption was usually trifling in amount, and in every way the disease was mild as a rule, the mortality was

something worth considering, and, worse than that, the inoculated disease was contagious, so that an inoculated person had to be secluded carefully for fear of spreading the disease in the ordinary way. In all cases, too, careful medical treatment was deemed necessary. On the whole, then, it was fraught with many grave perils. So great, indeed, were these perils, and so thoroughly were they appreciated, the the most civilized countries, as soon as vaccination had become established in popular favor, the practice was interdicted by law.

In various parts of Europe the common people - at least those of them who had much to do with dairies - gradually became aware of the existence of the disease termed cowpox, and of the fact that those individuals who had accidentally contracted it were rendered proof against the infection of smallpox. There is even fair testimony to show that some of these people, particularly the English farmer Benjamin Jesty, relying on their observation to this effect, employed intentional cowpox inoculation as a protective measure. These facts, however, do not detract in the least from the credit that all Christendom has awarded to a man who subjected the popular empression in question to the test of scientific investigation, proved its truth, and demonstrated its value to the world. That man was Edward Jenner, an English country practitioner. It was in the last quarter of the eithteenth century that he entered upon his course of enquiry, and on the eve of the nineteenth century he published his demonstration to the world. It was not a discovery; it was not an invention; it was more than either, a "matchless piece of induction" (Simon) . Filled as he must have been with the consciousness of his great achievement, Jenner set this good example to all investigators: that he did not make haste to convert the world; he first convinced himself. It may almost be said indeed that the rational and perfected practice of vaccination sprang complete from Jenner's hands. Doubt and ridicule he had to encounter at first, and afterwards envy and detraction; but the force of his facts and the symmetry of his deductions were such that the new inoculation soon spread the world over, and, save with a few fanatical objectors, has ever since maintained its sway. Leaving out of account the few conscientious and intelligent doubters (made such, doubtless, quite as much by the extravagant statements often put forth by those who from time to time think it incumbent on them to defend vaccination, as by their own misinterpretation of facts) who are often

associated with the noisy little body of actual opponents of the practice, we may say that the fact of vaccination really protecting the individual against smallpox has been taught to the whole civilized world. One of the most injurious statements ever made in the advocacy of vaccination is, that it always protects if properly done. When one of these illogical defenders of that proposition is confronted with the instance that disproves his assertion, he falls back on the allegation that in that instance the vaccination was not probably done. The manifest absurdity of such an argument strikes the doubter most forcibly; unbelief founded on this ground would never have arisen if the plain truth had always been adhered to: that the protection afforded by vaccination is not invariable, and that very often it is not permanent. In the infancy of the practice these facts were not known, but it is now many years since they became obvious to every fair-minded observer. The misapprehension of facts lies chiefly in the false deductions from the circumstance that the great majority of cases of smallpox occur in persons who have been vaccinated. But the explanation of this is very simple. Suppose that of one hundred persons vaccinated, twenty fail to be protected permanently; that all persons not vaccinated are unprotected: and that throughout the civilized world the proportion of vaccinated to unvaccinated persons is as ninety to ten. Making no pretence of arithmetical accuracy it may certainly be said that all these suppositions are well within the truth. It follows from them that in a community of ten thousand persons, there will be nine thousand who have been vaccinated, and one thousand who have not. Of the former eighteen hundred will have failed to secure lasting protection. Therefore, in case of an epidemic there will probably be a proportion of eighteen cases of smallpox in the vaccinated to ten in the unvaccinated; and yet this should not obscure the fact that of nine thousand vaccinated more than seven thousand were absolutely protected, whereas of the one thousand not vaccinated not one could escape the disease if exposed to it. When we add the further observation that of the eighteen hundred cases of smallpox among the vaccinated not more than thirty or forty would probably prove fatal, while of the one thousand cases in the unvaccinated about two hundred would end in death, we have a striking demonstration of the efficacy of vaccination. As a matter of fact statistics show that the figures here given err

rather in allowing too little than too much in favor of protection by the method under discussion.

The question arises, why is it that vaccination protects some persons and does not protect others ? ---- reference being had, of course, to permanent protection, for it is exceedingly rare for temporary immunity not to be attained if we exclude those instances in which variolous infection has taken place before the operation is resorted to. This question cannot be answered with any certainty, but various theories have been brought forward, some of which call for notice. In the first place, it has been thought that the revolution of the system termed puberty was fraught with such a radical change as to do away with the mild modification due to vaccination. While this theory has an air of plausibility, it seems to lack proof and not to be upheld by analogy, for we do not find that children who have had scarlet fever, measles and the like often undergo those diseases a second time on arriving at the age of puberty. The only remaining theory that need be considered here is that put forward by Marston, that the degree and duration of vaccinal protection are proportionate and to the protection of the vaccinal lesion and the number of insertions made. In a large experience with smallpox Marston found that the disease was more fatal among those whose vaccinal scars were imperfect or few in number than among those who bore evidence that several pocks had been produced and had run a typical course. As to the influence of a perfect evolution of the lesion, but little doubt can be entertained, for in some instances its course is so different from what it should be that no protection whatever seems to result . When we come to consider the number of pocks as affection the degree or the duration of protection, however, an obvious source of fallacy arises in the fact that we cannot always be sure that some of ths scars on a person having a number of them wee not the products of the operation several years after the first -- that is to say, a revaccination, the efficacy of which in restoring lost immunity is now well established. Nevertheless experience has proved that the best course to pursue is to vaccinate by multiple insertions in accordance with Mason's suggestion.

There are, then, no positive means of ascertaining who those persons are that are likely to fail of lasting protection, or how long a time will elapse before the cessation of their immunity will take place. The only safety lies in revaccination. But after how many years should this

be resorted to ? It has been thought that this question might be settled by noting at what age, or at what period after primary vaccination, large numbers of people become susceptible of revaccination. This test, however, is not altogether trustworthy, for a renewed susceptibility to vaccinia by inoculation does not necessarily imply that the liability to take smallpox by infection has been regained. If it did, modified smallpox, or varioloid would be far more common than it is, for it is certain that revaccination can be made to succeed in a very large proportion of children long before they have reached the age of puberty. The fact is, contrary to the notions of former times, that success in revaccination is the rule, not the exception; no special pains were then taken to ensure success as the latter event was not anticipated .

It is difficult to say what time should be allowed to elapse before vaccination is repeated, but in the great majority of instances safety may be attained by revaccination every five or six or seven years, and always in the presence of an epidemic, regardless of the lapse of time; also whenever one'smode of life is to undergo a noteworthy change, as under such circumstances as enlistment and emigration to a foreign country.

To epitomise: Vaccination almst invariably protects against smallpox for the time being; generally for a long term of years; sometimes for a lifetime. Often the protection is absolute; as a rule it is very nearly so; in rare instances it is trifling. In general terms it may be said that it is scarcely less protective than variolous infection itself, for death from a second attack of smallpox is by no means rare. Here the question arises: Is vaccination less protective either in degree or in duration of effect than it was at the time of its adoption ? Given a typical vaccinia, we may unhesitatingly answer, No; but do we now so invariably produce the disease in all its essential features as was done in Jenner's time ? Yes, provided we use proper virus and employ as much care as was taken by the older physicians, who, trained to the practice of variolation (the inoculation par excellence of bygone days) , did their work with a gusto now seldom witnessed. But there was a time , now happily at an end, when it was not easy to obtain thoroughly good lymph, and when, therefore, the result was apt tovary materially from the standard.

It would be foreign to the writers present purpose to further linger over the fascinating subject of the history of vaccination; nor is it

necessary for him at this time of day to devote much more space to refutation of the views of the fanatical "anti-vaccinationists". Before the introduction of vaccination the annual mortality in England and Wales alone was at the rate of 3.000 deaths per million of population -- this, according to the census of 1891, would correspond to a loss of some 87.000 lives per annum --- the population of England and Wales being 29.081.047 in April of that year. In 1890 smallpox caused only 15 deaths in England; and the average annual number of deaths from this disease in the years 1881 -- 90 inclusive was 1.227.8 -- that is one-seventhieth part of the death-rate recorded before vaccination came to be introduced.

A thorough investigation as to the influence of vaccination in reducing the prevalence of, and mortality from , smallpox has been made in England by a Royal Commission (Vaccination and its results, A Report based on the Evidence taken by the Royal Commission , 1889 --97. New Sydenham Society , 1893) , including amongst them many celebrated physicians. The following table gives carefully compiled statistics as to the effect of vaccination in five towns of England;

	Attack-Rate Under Ten	
	Vaccinate	Unvaccinated
Sheffield	7.9	67.6
Warrington	4.4	54.5
Dewsbury	10.2	50.8
Leicester	2.5	35.3
Gloucester	8.8	46.3
	Attack-Rate Over Ten	
	Vaccinated	Unvaccinated
	28.3	56.3
	29.9	57.6
	27.7	53.4
	22.2	47.6
	32.2	50.0

The Commissioners' Report clearly proves that vaccination favourably effects the death-rate and the severity of the disease . Thus, in Sheffield, of 4.151 vaccinated persons attacked, 200, or 4.8 per cent., died; of 552 unvaccinated persons attacked , 274. o4 4916 per cent., died; so that the mortality among the unvaccinated was more than ten

times greater than among the vaccinated. Of those attacked , 353 were vaccinated children under ten years of age, of whom 1.7 per cent. died; while of 228 unvaccinated children attacked, 43.9 per cent died; so that among children the disease was more than twenty-five times as fatal among the unvaccinated than amony those who had been submitted to the operation.

The commission found that with regard to the effect of vaccination in reducing the prevalence of and mortality from smallpox; (1) It diminishes the liability to be attacked by the disease. (2) It modifies the character of the disease, and renders it less fatal and of a milder and less severe type. (3) That the protection it affords against attacks of the disease is greatest during the years immediately succeeding the operation of vaccination; it is impossible to fix with precision the length of this period of highest protection; though not in all cases the same, if a period is to be fixed, it may fairly be said to cover in general a period of nine or ten years. (4) After a lapse of the period of highest protective potency, the efficacy of vaccination to protect against attack rapidly diminishes, but it is still considerable in the next quinquennium, and possibly never altogether ceases. (5) Power to mdify the character of the disease is also greatest in the period in which its power to protect is greatest, but its power thus to modify the disease does not diminish as rapidly as its protective influence against attacks, and its efficacy during the later periods of life to modify the disease is considerable. (6) Revaccination restores the protection, which lapse of time has diminished, but the evidence shows that this protection again diminishes, and that it insures the highest degree of protection which vaccination can give, the operation should be repeated at intervals (7) The beneficial effects of vaccination are most experienced by those in whose case it has been most thorough. The Commissions think it may fairly be concluded that when the vaccine matter is inserted in three or four places it is more effectual than when inserted in one or two places only, and that if vaccination marks are of an area of half a square inch, they indicate a better state of protection than if their area be in all considerably below this.

Dealing with the above reports, the Lancet of Februay 20th , 1897, agrees with other expressed opinion that if there is to be any relaxation of primary vaccination, we must have revaccination enforced by law.

QUARANTINE AND ISOLATION.

As soon as a case is known to be variolous the medical officer of health should be notified: indeed the law compels it. The patient should be at once placed in strict quarantine. In "self-contained" houses, it will be sufficient to keep apart from the rest of the family any supposed "contact" until the incubation period of twelve days ha passed by without the development of suspicious symptoms. In the case of tenement houses, or flats, the persons suspected to have contracted smallpox should be removed to a special building for detaining such individuals, which also ought to be within easy access, so that the dangers incident to the patient and community during transportation may be minimised. The sick should be removed to an hospital and there detained until every symptom of the disease has disappeared.

When impossible , in a private family to isolate one of its members actually, or suspected to be, suffering from smallpox, to isolate in a separate building, he should be relagated to a room at the top of the house forthwith, the same being deprived of all articles not in actual use. A sheet constantly saturated with carbolic acid, sanitsa, or chloride of lime, or other volatile disinfectant, should be hung outside the door. Particular attention should be directed to hygienic procedure and the sanitary appointments throughout.

DISINFECTION.

The object of this is to destroy the virus or contagious principle of the disease . The poison of smallpox is known to be very resistant to ordinary methods of disinfection, and may retain its virulence for several years; so far as bodily clothing is concerned the safest measure is destruction by fire. In fatal cases of variola the duties of the physician are not ended by the death of the patient. The corpses should be wrapped in sheets thoroughly moistened with a solution of perchloride of mercury (1: 1,000) The opinion is gradually gaining ground that the lifeless body should be disposed of by cremation, and that those of influence should agitate in favour of the legal enforcement of such a practice.

All washable articles, such as body-clothing, curtains, towels, handkerchiefs, and underclothing, should be folded without shaking and making a dust and placed in sheets dipped in corrosive sublimate solution (1:1,000) or one of chlormated lime, then boiled for an hour, and thereafter exposed to air and sunshine. After the sick room has been

vacated, the floors, windows, door, furniture, etc., should be rubbed with cloths, sponges, or brushes dipped in the solution of perchloride of mercury and afterwards cleansed with soft soap. Articles which cannot be washed, as upholstered furniture, cushions, mattresses, curtains, etc., must be disinfected in specially constructed disinfecting chambers by means of dry heat or superheated steam. Mattresses and cushions are to be laid open for disinfection in this way, but old clothing, carpets, ornaments, rags, and articles of little value had better be burned. The room should be fumigated with perchloride of mercury, chlorine gas, the windows, doors, and other apertures being meanwhile closed for several hours and thereafter opened for free airing of the room. As an extra precaution and to neutralize any of the mercurial vapour which may linger about the room, Konig, of Gottingen (Centralbl. f. Chir., 1897), recommended the following procedure as simple and effectual; On the following day the room must be again closed and sulphur, 1.361 grammes to 400 cubic metres of air-space (3 pounds to 1000 cubic feet, burned in the same way and the fumes retained four hours. Should it be necessary to enter the room during the process of fumigation, precaution must be taken to hold a moist sponge or damp cloth over the mouth and nose in order not to inhale the vapour. The roomand its contents should then be thoroughly scrubbed with strong potash soap or a perchloride of mercury solution (1:2,000), special attention being directed to the cleansing of all corners and cracks, when it may be redecorated in the usual way. Konig, since adopting this method of disinfection has never seen a second case of smallpox, or other disease, due to infection remaining in the room.

A convenient, though somewhat costly method of disinfection is by means of Reynolds thiocamf, introduced in 1890. Thiocamf is a liquid combination of sulphur dioxide, camphor, and various volatile aromatic bodies, which possess the remarkable property of giving off a very large volume of effective germicides on mere exposure to the atmosphere. To utilize, the air of the closed apartment is first moistened by sprinkling hot water freely about; a sufficient quantity of thiocamf (about six ounces) is then poured on a large flat dish or old tray, and the room is shut up for two days. On opening it at the end of that period the usual cleansing and ventilation should take place.

Formaldehyde has been introduced by Harrington (Amer. Jour. Med. Sci., 1893, p. 56) as an efficient surface disinfectant; it is best suited to that purpose in aqueous solution of a strength of from 10 to 20 per cent., a spray of at least 15 per cent. being admirably adapted to general interior or furniture disinfection. Clothing may be immersed in such a solution and then dried in the open air. After spraying the walls, ceiling and floor, all articles in the room should be washed with formalin solution (15 or 20 per cent.) allowing 24 ounces for each 1000 cubic feet of space, and the doors and windows closed for four days.

In the country the excreta should be disinfected in a suitable vessel containing about an ounce of a fresh chloride of lime solution and buried a considerable distance from a well or dwelling. If passed dwn a water closet the basin should be disinfected with the solution or one of corrosive sublimate.

TREATMENT OF THE DISEASE.

Nursing and Hygiene.

Important consideration to be regarded at the onset of the management of the small pox patient relate to his hygienic surrondings and nursing -- considerations which scarcely differ from those recognised as of general importance in the case of all septic, filth-producing and contagious diseases. The timid fearful, and the unprotected are to be at once dismissed from the bedside, and trustworthy attendants , who have received protection either by recent vaccination or a prior attack of the malady. The sick-room should be sufficiently large and capable of the most thorough ventilation by free access of air. The temperature of the sick chamber during the febrile stages of the disorder should not rise above 70°F. nor permitted to fall below 60°F. Between these extremes a variation may be made in accordance with the sensations of the patient.

PHOTOTHERAPHY

The treatment of smallpox by means of red light is a very old one. John of Gaddesden advised that red curtains, red walls, and red furnishings, be employed, for he believed that there was a peculiar virtue in this colour. After the lapse of centuries the subject of light has attracted attention since 1867, when Black (Lancet , June 29, 1867), of Chesterfield came to the conclusion that the complete exclusion of solar light from the eruption of smallpox in persons unprotected by

vaccination effectually prevents pitting of the face Subsequently Waters (Action of Light in Smallpox, Lancet, Feb. 1871), of London , asserted that if while light (day-light) is entirely shut out from the patient the disease will be less severe. In the same year, Barlow (Lancet, July, 1871), of Manchester , advocated exclusin of light in the treatment of variola. He mentions an experiment made in which the face of a smallpox patient was covered with a warm solution of coloured gelatin (to exclude the actinic rays) , the rest of the features being left exposed to the full action of light, with the result of showing a marked contrast between the two portions; the protected side, being less severely affected, showed little or no scarification, while the part remaining free was covered with deep, suppurating lesions and consequent marked disfigurement. Barlow further advocates the necessity of exercising care and judgment in the application of treatment by exclusion of light, suggesting that only the actinic rays of the solar prism should be cut off, obviating the depressing effect in the mind which total darkness would probably cause.

Gallavardin (Lyon Med. 1892. lxx. pp. 220 et. seq.) reports having carefully studied for seven years the effect of the exclusion of light in the treatment of smallpox. His method was to place the patient in total darkness, and he found it effectual only when thoroughly carried out, in which case suppuration and pitting were prevented.

Unna (Monats. f. prak. Derm., 1885, p. 285), Widmark (Hygiea Festband, No.3 and Biol. Fören. Förhandl. Verhandl. d. biol. in Stockholm, 1888, i. 131---134), and Hammer (Neber den Einfluss des Lichtes aug die Haut. Verhaud. d. deutsch. dermat. gessellsch., Wien, 1892, pp. 329 at seq.) have determined that it is the chemical rays (especially the ultra - violet) of sunlight which alone are active in causing both pigmentation and solar eczema. Hammer and Widmark have shown that the same phenomena may be produced by strong electric light, since it is particularly rich in chemical rays. These observers have also shown that the chemical rays constitute essentially the blue and violet, especially the ultra-violet part of the spectrum, which of all light rays are the most refrangible. Under their influence chemical activity is weakest. The converse of this holds good in the other end of the spectrum , where the red rays are found to be the least refrangible, while with them the coloric activity is greatest and the chemical activity the least so.
heat as the active agent in the production of the

in question Hammer and Widmarsh mention the fact of Arctic explorers and tourists on glaciers, even with the temperature below freezing - point, may suffer severely from light erythema, due to the ice fields causing light to be strongly reflected.

Finsen (Om Lysets Indvirkinger opaa Huden, Hospitalstidende, July, 5, 1893; ibid., Sep. 6. 1893) states that in an epidemic of smallpox which prevailed at Bergen in the summer of 1893. Lindholm, medical officer of health, and Svendsen, visiting physician of the Municipal Hospital, used either red curtains, which were kept tightly closed, or windows of red glass in the apartments occupied by variolous patients, with qualifying success. When these precautions were thoroughly carried out oedema quickly subsided and suppurative fever did not appear. There were 20 patients thus treated, 10 of whom were unvaccinated children, and in all, though severely attacked, recovery took place. In one case of black smallpox the eruption dried up shortly after its appearance, no fever of maturation took place, and only a few scars were produced. Svendsen (Medicinsk Revue, Oct., 1893) has also published an account of the treatment of variola by means of red light during this epidemic in which his former experience was confrimed. In all cases the vesicles dried up without becoming purulent, suppurative fever was consequently avoided, and the disease became less dangerous, less protracted, and less painful from absence of ulceration, and there was no pitting. Experiments were made by allowing two patients who had passed through the stage of desiccation on the face, the disease being still active on the hands, to have free access to daylight, whereupon the lesins on the hands immediately took on a more active condition resulting in suppuration and deep pits on the back of the hands in both cases. He concludes by saying that the clinical records of cases thus treated show the following important differences; The suppurative stage - the most dangerous and troublesome in smallpox -- was slurred over; no rise of temperature, no oedema, and so on, occurred; the disease passed at once from the vesicular stage, which in the cases observed seemed to be somewhat protracted, into that of convalescence, and were saved the disfigurement of pitting.

Later the method has been tried by Juhsl - Renoy (Bull. st Mém. de la Soc. Méd. des Hôp., Dec. 14, 1893), of Paris, with less striking, though still encouraging results. He believes that the chemical rays of light cannot prevent suppuration, but lessons it to a marked degree, and are capable

of rendering the post-variolous scars less perceptible and less disfiguring.

Feilberg (Hospitalstidende, July, 4, 1894), senior physician of the Presmund Hospital, Copenhagen, describes having treated fourteen cases of smallpox by exclusion of the chemical rays of light, in an epidemic which occurred in 1894. The results are in all cases satisfactory, and stand as valuable testimony to the efficacy of phototheraphy in variola.

D I E T.

The indications for diet in smallpox are similar to those arising in the course of other acute fevers. The only point to be noted especially is that the supporting diet should be begun early, as in the severe cases the extensive suppuration marks a heavy drain upon the patient's vital recources. During the first stage of the disease there is little desire for food. The diet should be liquid, albumin - water, and the like.

Intense thirst is generally present, and this may be relieved by water, lemonade, or the carbonated waters, in free potations . When the initial fever subsides and the patient feels improved, it is well to allow any light nutritious food he may desire -- milk, eggs, chops, steak, or roast meat; bread or toast; and the more easily digested vegetables, such as well-cooked potato, spinnach, celery , asparagus-tips, cauliflower tops, and the like are all suitable. When the second period of the fever comes on, a return to the liquid diet may again be made. The diet should be as ample as possible, and the food be given at regular intervals every two or three hours during the day and every three or four hours at night. Milk, plain or peptonised, milk-punch, raw eggs, egg and sherry and the various combinations and dishes made of eggs and milk should be given. Broths , beef-juice, and the like may be added to the bill of fare. When there is marked dysphagia, as there is apt to be in all severe cases, the food is best given cold, at more frequent intervals and in smaller quantities: rectal feeding has to be resorted to in some cases. In severe attacks alcohol is required and may be given from time to time as the condition of the patient demands. Whisky, brandy, and

port wine are, as a rule, borne best; the whisky or brandy should be given in diluted form, combined with a small amount of glycerine or syrup to avoid irritating the throat. Stimulants may be added to the milk, or they may be given in the form of milk-punch or egg-flip, according to the patients taste. Alcohol should not be given as a routine practice in all cases, as was formerly done. Usually little or no stimulation is required in mild cases and even those of moderate severity, when the patient is under twenty. As soon as the fever declines, meat may be added to the dietary, and when the appetite and digestion allow, and during convalescence, other articles of food may be allowed and the diet increased rapidly forthwith.

G E N E R A L T R E A T - M E N T.

P R O D R O M A L S T A G E.

The prodromal stage of variola calls for no special interference as regards its management for we know of no certain means of aborting the attack. Welch (Smallpox . Amer. Syst. Pract. Med., 1897, vol 1. p. 513) recommends the vaccination of all patients at the earliest possible moment before the maturation of the pocks; but, as vaccine pustules and smallpox pustules can develop side by side, the futility of the procedure is apparent.

The patient need not be confined to bed if the attack be mild. He must not, however, on any account, leave his room, and the advisability of rest must at all times be empahsised. If vomiting and retching be present relief may be had from the suchking of ice. Hot applications and counter-irritants must be avoided as they convert a discrete eruption into one that is confluent. Headache shuld be treated by cold compresses or ice-bags. At this stage of the disease medicines are best withheld, though severe lumbar pain, excessive vomiting, and excruciating pain in the frontal region may demand five or ten grains of morphia. The old attempts to cut short the disease by sweating, vomiting, purging, and bleedings are now entirely discarded as likely to lead to dangerous depression. As the fever rises , and during its height, tepid sponging, wet-pack-bathing are commonly grateful , and, as a rule, are accompanied by no danger to the patient. The temperature of a bath to commence should not be below 95°F.; it can be gradually cooled down to 85°or 80°F., as needed The method is, however, only indicated when the fever is high, for the early periods of the disease it is apt to retard the evolution of the cutaneous symptoms. The regular action of the bowels should be assiduously promoted by such mild aperients as Hunyadi water, Epsom salts, and Seidlitz powder.

E R U P T I V E S T A G E.

This is the more serious stage of the disease than the foregoing and requires careful supervision in the wa y of prevention of : (1) Collapse from the severity of the illness; (2) the absorption of septic material; (3) complication. The treatment will depend on the extent and character of the eruption and be, generally speaking, sympathetic . Varioloid calls for

no special interference, but the confluent and haemorrhagic varieties require prompt attention to indications arising.

INTERNAL TREATMENT.

In confluent variola the patient must be kept in bed and his dietary carefully arranged according to the demands of the disease upon the vitality , as already described. From first to last in the treatment of smallpox, all indications should be made subordinate to that most prominently set forth by the general character of the symptoms - viz; the convervation of the vigour of the patient by every possible means. The tax upon all reserves of vital energy is here so enormous and constant that he will gravely err who for a moment loses sight of the fact. Hence it is that anodynes, choral, opium, and its alkaloids, the bromide of potassium, and similar medicaments given either by the stomach or by hypode rmic injection, are to be jealously reserved for emergencies when it would seem cruel to withhold the comfort they may impart. Stimulants, are, of course, to be freely employed whenever they are indicated by exhaustion, as this may be shown by a weak pulse and other failing functions of the body, but are certainly best reserved for such emergencies. In general, it may be remarked that the fewer the medicaments ingested by the stomach, and the larger the restriction of the labour of this organ to the task of sustaining the nutrition of the body, the better are the chances of the patient ultimately conquering his dangerous disorder.

To prevent the absorption of septic materials from the extensive pustular lesions, almost all known substances have been used both externally and internally without any marked effect. Foot (Dublin Jour. Med. Sci., vol. liii, pp. 242 et seq.) gives sulphocarbolate of sode, in diluted doses of 6 to 10 grains every three hours, and by copious draughts of sulphurous acid in a glass of iced water, and a weak laryngeal or nasal spray of sulphuric or carbolic acid.

Pepper (Amer. Jour. Med. Sci.; March, 1893) advocates cocaine in the treatment of variola vera and varioloid, which he claims to be capable of being arrested in a marked degree as often as not by that remedy. He believes that the disorganisa-

tion

of the blood is generally less rapid and less extensive, that the fever is less severe and of shorter duration, and that often the lesions undergo incomplete or semiabortion under its use. In addition to this, he maintains that the visceral congestion and inflammation are not so frequent, and that when present they are less intense. Five drops of a four-per-cent. solution can be given four times in the twenty-four hours to a child five years old, and increased one drop for each year until, at the age of twenty, twenty drops are taken at the same intervals. Each dose is to be given in a small quantity of water or otherwise according to taste. It may also be given in suppositories every six or eight hours, the quantity of the drug given thus in the twenty-four hours never being greater than that given by the mouth. Pepper does not recommend the hypodermic method except in the incipient stage when the drug canno t be given by the mouth or rectum; the dose should be a quarter of that indicated for use by the mouth. The effect of cocaine must, however, be carefully watched in spite of the marked tolerance for the remedy in this disease. This treatment is not urged to the exclusion of other remedies, general or local, but Pepper observed that in many cases in which cocaine was methodically administered, little or no further treatment was required. He also suggests that during a smallpox epidemic it is worthy of a trial, by way of prophyloxis,upon the unvaccinated and those partixularly exposed to infection.

Quinine forms a reliable tonic and antiseptic in the treatment of smallpox. It is best administered in doses of five grains three times a day or oftener. Any of the liquid preparations of the drug may be substituted for the pure salt if desired.

Tincture of the perchloride of iron is a favorite with many, and, in addition to its tonic effect, makes a useful astringent gargle when the mouth and pharynx are much involved.

Iron and quinine are sometimes indicated in combination; the ferri et quinine citras may be given with spirit of chloroform and infusion of calumba or plain water; or the same scale preparation may be administered in five-grain doses in effervescence with granular effervescent citrate of caffeine.

Strychine may be combined with iron and quinine, or given alone by the mouth or hypodermically. The dose should vary with the age and general indications. Nitroglycerine (1/100 grain) may be used in cases of emergency.

Diarrhoea usually yields to opium, and $\frac{1}{8}$ to $\frac{1}{4}$ grain of morphia seldom fails to induce sleep. For the latter purpose chloral hydrate is to be preferred in the case of children. On account of the irritating effect of this drug upon the pharynx and larynx when these parts are implicated by the lesion, it may be given in the form of an enema ($1\frac{1}{2}$ to 2 drachms with 8 ounces of water or mucilage). Digitalis is likewise of value even in cases of insomnia, and was highly recommended by Murchison in ,ixture with liquor opii sedations, spirit of nitrous aether, and camphor water. To reduce the fever two or three grains of phenacetin may be taken every second hour until the temperature falls or several doses have been given. In haemorrhagic variola iron is indicated in full doses (20 to 30 minims of the tincture every three or four hours), as also are ergot, turpentine, and taunic acid. In these almost hopeless cases transfusion of blood and inhalation of oxygen may be tried.

When the variolous lesion involves the intestinal mucosa, giving rise to copious diarrhoea, something more than the measures previously suggested may be necessary. In such cases a starchy diet, brandy or port wine, and poulticing or applying wet compresses to the abdomen may be resorted to. If effective , solution of pernitrate of iron may be administered, or pills of acetate of lead and opium, or - in the case of children - aromatic chalk powders. An excellent remedy is a small starch enema, containing ten to twenty minims of the tincture of opium. If the evacuations show signs of blood, spirits of turpentine, in five - minim doses may be given . In cases of flatulent distension of the abdomen or hiccough thirty-minim doses of tincture of sumbul may be serviceable; or such measure s as hot fomentations, turpentine stripes, ice-bags, and high enemata.

L O C A L T R E A T M E N T.

Almost without number have been the topical applications made to the surface of the skin in the pustular stage of smallpox, both with a view to assuage the pain and soreness and to obviate the tendency to pitting. The opening of the pustules and the evacuation of their contents - practicable only in other than confluent forms of the disease) has been practised from an early date, but is ineffectual from the standpoint of any practical results thus obtainable. The same may be

said of the subsequent cauterisation of the floor of the pustular chamber, which only adds to the distress experienced by the sufferer in his skin, Medicated ointments, applied to the skin, containing mercury, iodine and other substances, are not known to be followed by any better results. It may indeed be laid down as a general rule that fatty applications to pus-producing surfaces where the pathological product is virulent are apt to undergo decomposition and otherwise act unfavourably upon the tissues - a fact first pointed out by Ricord in connection with the treatment of chancroid. Vaseline is, however, not open to this objection, as it is not liable to undergo chemical de-composition.

Authors are usually in agreement respecting the value of water-compresses over the surfaces invaded by the eruption . Compresses may take the form of those dipped in ice of of those moistened with tepid water. The sensation experienced by the patient will prove the best guide to the temperature of this fluid. Some prefer to use a solution containing one drachm of boracic acid to the pint of water as hot as can be discovered to be productive of comfort, a drachm or two of glycerine being added to the solution. The compress dipped in this --- a carbolated solution, if the latter is preferred by either physician or patient, should be assiduously moistened and changed regularly by the attendants just as long as the do good. They operate, first, by protecting the part; second , by keeping it moist; third, by maintaining the surface temperature at the point most pleasant to the patient; fourth, by exercising the gentlest degree of equable compression over the surface. This may be covered by a piece of oiled silk to prevent evaporation, When desired..

The greatest comfort may be afforded the patient by means of warm baths, administered either by the process of continuous immersion - so generally practised in Vienna -- for from two to three hours of each day -- The skin is thus speedily relieved of its tension, the exfoliation of the crusts is hastened, and the time required for the exfoliation of the cutaneous lesions, if not shortened, is at least not retarded by the accidents of exposure of the desiccating influences of the atmosphere - ends which for the patient are practically one. In private practice , by wrapping the patient completely in sheets wrung out of water, of the temperature desired, nearly the same result may be reached.

Stokes (Dublin Jour. Med. Sci., vol. liii, p. 9.) of Dublin, believes that the exclusion of air, keeping the parts moist to prevent hardening of the scabs, and the lessening of local irritation

are the three most urgent indications for local treatment. The first of these indications can be met by painting the affected parts with flexible collodion or various kinds of masks. Lewentaner (Bull. Gén. de Ker., No. 32, 1869) uses a mask made of a thick paste or ointment of salicylic acid, 3 parts; starch, 30 parts; and glycerine, 70 parts. Bertrand (Gaz. des Hôp., July 15 and 17,18) paints, where necessary a mixture of boracic acid (1 drachm) and glycerine (43 ounces). A satisfactory paste is that composed of carbolic acid (4 to 10 parts), olive-oil (40 parts), and prepared chalk (60 parts.) It can be applied spread on linen and changed twice in the twnety-four hours. The French physicians speak highly of a mercurial plaster (Vigo plaster). Ihle's Paste, which is a mixture of ten grains of resorein with two drachms each of powdered starch, oxide of zinc, lanolin, and vaselin, would probably suit some cases. In the earlier stages of the eruption benefit may be derived fom the use of antiseptic and astringent dusting powders, such as boracic acid, subgallate of bismuth ("dermatol"), refined fullers earth (Emol Keleet), or a powder composed of pure liquified carbolic acid (half a drachm), and two ounces each of zinc oxide and pulverised lycopodium-all of which tend to allay the irritation of the skin.

Mac Combie, while testifying to the irritation produced by the application of oily substances and poultices to the skin, strongly recommends the early separation of the crusts, no matter where located. This he does by the application of linseed meal poultices, sprinkled with iodoform. On the face he finds that patients do not object to wearing a mask (cut out of a single thickness of lint, with aperatures for the eyes, nose, and mouth), smeared with a thin layer of linseed-meal poultice inside; He takes care to put on the surface a little vaselin to which iodoform has been mixed - greasy applications, he says, do not at this stage (that of decrustation) irritate the patient - before applying this poultice to the face. If changed every two hours, oroftener, the crusts were found to separate with striking rapidity.

Marson, formerly of the London Smallpox Hospital, was in the habit of waiting until the pustules had burst and the discharge had begun to dry, when he applied olive-oil, or a mixture of glycerine and rose-water in the proportion of one to three. He also advocated the use of cold cream or oxide of zinc ointment, or Carron oil (a mixture of olive-oil and lime-water). These, however, frequently fail to produce the effect claimed for them; they are difficult to apply and keep in

keep in position; and are more or less disagreeable tothe patient.

Hoerschelmann (St. Petersburg med. Woch., 1898, N.F., xv, pp. 383 - 386) speaks in emphatic terms of ichthyol, applied in the strength of from 20 to 50 per cent.

In order to fully secure local asepsis, Foote applies to the face carbolised oil (1: 4 or 1 : 8); as early as possible paints the papules with flexible collodion: sponges the body with solutions of sulphurous acid, and frequently burns a little sulphur in the room.

Talamon (Med. Mod., April. 17. 1890) has convinced himself of the efficacy of ethereal solutions of various antiseptics in the form of a spray. He recommends salol only when the rash is slight and scanty; but prefers corrosive sublimate in all cases. His procedure consists in spraying the part for a minute three or four times a day, until desiccation takes place, with a solution composed of corrosive sublimate and citric acid, of each 15·432 grains; alcohol (90 per cent.), 80 minims: and ether, sufficient to make an ounce and a half. During the application the eyes should be carefully protected.

As anything that leads to hyperaemia of the skin increases the eruption,and the converse is also true, the patient should wear a mask, (arranged as already indicated), from the very onset of the illness, saturated with iced water and frequently changed until the stage of desiccation. When there is high fever, and the exanthem promises to be confluent, the scalp and beard should be closely clipped and cold applications made to the confluent lesions as early as possible. With the maturity of the latter, carbolic, perchloride, or boracic solutions may be fomented or applied in the same way, and changed every quarter of an hour. The pustules may be let out with a lancet, and their chambers flushed with corrosive sublimate. by means of a glass syringe. Warm baths, as already mentioned, are at this time especially, very useful, and refreshing. The water may with advantage be tinged with permangamete of potassium solution, bearing in mind, however, that this is rendered inert and decolorised at once. by soap or any organic matter, such as sponges, cotton wool. wadding, or flannel.

It need hardly be added that all other indications presented in any given cases are to be met, subject to the condition s indicated above. Abscesses are to be opened and antiseptically treadted; delirious patients are to be seduously prevented from doing themselves injury; daily movements of the bowels are to be secured; while the diarrhoea occasionally resulting from the exhausted condition of the system when the force of

the disease is spent, demands the proper control. Cleanliness is to be enforced by every judicious measure. The skin of the patient is to be washed in tepid water and soap as often as practicable in the course of the disease, and under no circumstances are applications of ointments, washes, lotions, etc; to be allowed to collect in strata upon the surface commingled with the pus and crusts of the disease. At the time of such ablution, and occasionally oftener, the linen and other garments of the patient are to be changed.

In conclusion complications and sequelae are to be treated as when occurring under circumstances other than variolous.

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